THE 1950 YEAR BOOK of GENERAL SURGERY

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Section on

ANESTHESIA

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ANESTHESIA

an operation no longer carries with it the dread of a severe spreading infection.

The amazing lowering of operative mortalities, however, has been due by no means only to the widespread use of the new antibacterial substances Other factors also have played important roles. One of these is the realization of the great importance of large blood transfusions. When, shortly after World War I, the transfusion of whole blood was made simple and practical by Lewisohn's suggestion to use citrated blood, surgeons were quick to adopt the method as a life-saving measure in the treatment of massive hemorrhage Usually, however even in such cases the amount of blood used was small as judged by present standards Experiences in World War II with the administration of enough blood to accomplish replacement of the volume lost led all surgeons to the realization that, in general, patients undergoing severe operations would make better and quicker recoveries if they were given blood during operation in larger amounts than had been customarily employed Whereas a decade ago a patient during an operation seldom received more than 1 unit (500 cc.) of blood, now it is not unusual for 3 or 4 units to be given even when there has been no massive hemorrhage Actually however the better condition of the patient after a serious operation nowadays, as compared with the condition formerly seen, indicates that usually during the course of an operative procedure much more blood is lost than is appreciated. The older studies of Gatch and the more recent ones of Gross concerning this point seem to be confirmed.

Another factor of great importance in reducing operative mortalities has been the marked diminution in the occurrence of so-called postoperative pneumonia. Formerly a frequent and often fatal complication, especially of abdominal operations, it is now comparatively rare. This change has been due in part to the help provided by the antibiotic drugs but perhaps to a greater degree by the prevention of atelectasis and prompt direct treatment when it does occur The older work of Coryllos and of Walter Lee which showed the relationship of bronchial obstruction to atelectasis and of that in turn to postoperative pneumonia has borne fruit in recent years by the frequent aspiration of bronchial se-

cretions during and immediately after a major operation This has also entailed much greater use of the bronchoscope for aspiration of the air passages in the immediate post operative period.

This reduction in the incidence of atelectasis is also an indication, especially in the United States of the greatly improved anesthesia now practiced as compared with that of a decade ago This improvement in the administration of anesthesia has shown itself in other ways Owing to a better realization of the dangers of hypoxia and because of better methods of preventing it a patient may now be expected to go through a very serious and protracted operation with his blood well oxygenated at all times Undoubtedly many operative deaths in the past which were ascribed indiscriminately to shock were due chiefly to hypoxia induced by improper anesthesia

The prevention of pulmonary embolism has received much attention in the last decade Several approaches to this problem have been developed Early postoperative ambulation has been revived to prevent stasis and thereby clotting of the blood in the veins The custom is probably as old as man himself Certainly primitive people get up and about as soon as possible after receiving a wound Indian squaws are said merely to have dropped out of their tribe when on the move in order to accomplish childbirth and to have rejoined the group a few hours later It is curious that surgeons ever got the idea of the necessity of a prolonged stay in bed after an operation. The explanation was probably chiefly the fear of the consequences of a possible infection such as dehiscence of the wound, hemorrhage and incisional hernia. It is fortunate that the revival of the practice of early ambulation was nearly coincident with the discovery of better drugs for the prevention of infection. The more frequent and prompt use of anticoagulants (heparin and dicumarol*) when signs of thrombophlebitis or phlebothrombosis appear undoubtedly has had much to do with the diminished incidence of pulmonary embolism. Finally the bold and radical attack on the source of the emboli by venous ligation, which has been largely developed and popularized in the last 10 years, has also served to prevent their transportation to the lungs. This procedure however has perhaps been too en

thusiastically carried out, and there seems now to be a tendency to become more conservative in the performance of venous ligation. Ligation of the inferior vena cava, for example is not so innocuous as many formerly believed.

Another important chapter in making an operation safer for the patient has been the attention devoted to his metabolism, especially his need for adequate nutrition during the postoperative period. Of prime importance in this respect has been the intravenous use of substances which will build *protein in the body* *Just a little more than a decade ago* Robert Elman for the first time injected intravenously into the human being a mixture of amino acids for this purpose From that pioneer work there has developed a vast amount of research and developments which has made it possible to supply the protein needs of a patient by intravenous feed ing *To patients unable to take food in the normal manner* this parenteral feeding of protein has become of the greatest importance until such time as he can again be fed by mouth. Water carbohydrate electrolytes, vitamins and protein can now all be administered to a patient by vein. The only food substance which cannot yet be so given is fat It seems probable that *this problem also will soon be solved* Thus an important chapter in providing complete alimentation by a parenteral route will be finished.

The fundamental principles of wound healing have been better understood during the decade with the result that wounds become more securely and often more rapidly healed than they previously did *The importance of an adequate* supply of protein and more particularly of vitamin C in this process has been more generally realized. Following Lister s discovery of the action of bacteria in delaying wound heal ing and of a method of excluding them from a wound more than a half century elapsed before any fundamental and *noteworthy contribution was made to this subject* Lister s discovery, important as it was, really constituted a negative approach. It involved the exclusion of a factor which interfered with wound healing Conversely the discovery of the importance of protein and vitamin C can be considered a positive contribution because it implied the *addition of necessary factors which might be lacking* Doubtless the time will come when, by virtue of a better

knowledge of the fundamental chemical processes involved, it will be possible to shorten the time now required for the healing of a wound Perhaps the process eventually can be shortened to a period of two or three days. Even in the past decade we have seen the average hospital stay after major operations reduced by about one third or one half of what it generally was 15 or 20 years ago

Mention has been made of the importance of vitamin C in wound healing Another vitamin K, has come into frequent use during the last 10 years. The help from the use of this substance in the handling of patients with severe jaundice and with impaired liver function has of course done much to remove the former hazard of severe bleeding during operations on such patients While discussing the control of hemorrhage certainly we should not fail to mention the value of some of the products put out by the drug manufacturers during World War II Of these the best known and probably the most used are Gelfoam and Oxycel As every surgeon knows, they are of great value especially in controlling the bleeding from an oozing surface

Probably the most spectacular developments in the last decade have been in the field of thoracic surgery Conditions hitherto considered beyond the reach of the surgeon are now being successfully attacked with increasing frequency The pioneer work of Gross in ligating a patent ductus arteriosus and that of Blalock in his successful operation for pulmonary stenosis had a dramatic effect on surgeons which was almost contagious As a part of this effect, much interest has been renewed in the idea of the surgical correction of abnormalities of the inside of the heart The interest which existed in this subject 25 years ago waned until recently Now however methods for the correction of abnormal heart valves and for the closure of septal defects are being developed at a furious pace At each annual meeting of the American Association for Thoracic Surgery a considerable part of the program is devoted to that subject Already much success has been achieved, and it seems probable that the time is not far off when a patient with severe mitral stenosis can expect to be relieved of his disabling condition by an operation associated with a respectable mortality rate

The inside of the heart constitutes the last anatomic frontier of surgery Every other organ has been successfully operated on for a great variety of conditions. New operations will, of course, be devised and existing ones modified, but it seems impossible to imagine how any new field of operative surgery can be opened up after the surgical correction of abnormalities within the heart has become practical. It is possible, however, that transplantation of organs in the future may become feasible If so that can doubtless be considered an anatomic frontier still open. On the other hand, the physiologic frontiers of surgery are by no means closed The amazing and gratifying amount of physiologic research by young surgeons which is reported every year at the Surgical Forum of the American College of Surgeons *is sufficient evidence of that fact.*

Another aspect of thoracic surgery which has had a remarkable development during the last decade has been that concerned with the esophagus Until recently the sporadic attempts which were made to resect that organ for carcinoma and other conditions were so seldom successful that an enormous amount of courage was necessary on the part of both surgeon and patient to go through the operation. Now however that situation is completely changed and successful resections of the esophagus are commonplace in thoracic surgical centers. Great credit is due Phemister and Adams for demonstrating in a case of resection of the lower end of the esophagus that the stomach could be successfully transplanted into the thorax for an anastomosis with the proximal end of the esophagus Sweet has greatly enlarged the possibility of such a transplantation and has contributed much to the practical establishment of esophageal resection as an operation which not only is feasible but is associated with a reasonably low risk. The contributions of *Levin and of Haight to the correction of congenital tracheo*-esophageal fistulas have made it possible to save the lives of many babies who otherwise would have died Heller's operation of myotomy of the lower end of the esophagus in cases of cardiospasm or achalasia has become popular in the last 10 years This simple and safe procedure has proved its value in the relief of an intolerable cause of invalidism.

Pulmonary resection in certain cases of tuberculosis,

largely under the leadership of Overholt has become a routine procedure This form of treatment has restored to health and normal activities many patients who otherwise would have faced lives of invalidism Attempts to resect lobes of lungs containing tuberculous lesions were some of the first operations undertaken on the lungs but those early attempts were unsuccessful. Later when the principles of thoracic surgery became more clearly understood a few such operations were successful but many others were not Really not until the last decade when all operations became safer and particularly when the proper indications for pulmonary resection for tuberculosis were more clearly and definitely drawn did the removal of a segment of a lobe, of a whole lobe or of a whole lung for tuberculosis become reasonably safe and popular

Pneumonectomy for bronchogenic carcinoma has become a common operation in thoracic surgical centers. After the first one in 1933 relatively few such operations were performed until about 10 years ago and the early ones were associated with a very high mortality Now however in several large series the mortality rate has been less than 10 per cent All those factors which have lowered the risk of all operations have been effective here also In particular the use of penicillin has greatly reduced the incidence of a postoperative opening of the bronchial stump Many patients who have had a lung removed for cancer have now lived beyond the conventional five year period without recurrence The first patient is alive and well more than 17 years after his operation. The diagnosis has been materially improved by the examination of sputum and bronchial washings for cancer cells, but even yet far too many patients reach the surgeon too late In recent years much evidence has been accumulated which indicates that excessive cigaret smoking is an important etiologic factor

With the increase of pulmonary resection it has become apparent that in many cases it is desirable and even necessary to examine the patient before operation by means of respiratory functional tests in order to determine whether or not he can spare a lung or even a lobe without becoming too dyspneic as a result A patient may become a respiratory cripple for whom life is intolerable if more lung tissue

is removed than he can spare A patient with severe pulmonary emphysema may not be able to give up a lobe much less a whole lung without the production of very severe dyspnea To avoid such serious consequences therefore, it is desirable to determine before the operation, in a doubtful case what the respiratory reserve is likely to be after the loss of lung tissue The leader in devising such studies was Cournand at Bellevue Hospital Other similar physiologic laboratories known to the author are that of Comroe at the University of Pennsylvania Hospital and the one of Roos at Barnes Hospital

In abdominal surgery one of the outstanding contributions in recent years has been the introduction of vagotomy by Dragstedt for the control of gastric acidity in the treatment of peptic ulcer This is an interesting demonstration of the value of a training in physiology for one who contemplates becoming a surgeon Surgery could use many more young men who have had an intensive experience in physiology as Dragstedt had The practical value of vagotomy is a controversial matter and perhaps there was too enthusiastic acceptance of the idea at first To the writer however it seems so logical and so simple a procedure in itself that it is likely to find a permanent place in the surgical treatment of at least some kinds of ulcers.

Another important contribution to abdominal surgery has been the splendid work of Allen Whipple in devising a practical surgical approach to the hitherto baffling problem of carcinoma of the head of the pancreas Although the five year results have been disappointing in regard to the pancreas a similar operation for cancer of the region of the ampulla of Vater has given gratifying results. Greater experience with the operation for carcinoma of the head of the pancreas may still show better results than those that have been so far obtained

Within the decade the surgical treatment of abdominal and pelvic cancer has become much more radical than formerly This trend has been due largely to Brunschwig who showed that patients with seemingly hopeless and inoperable carcinoma can sometimes be given at least some years of palliation and occasionally periods of five year survivorship by means of very radical operations which sometimes

amount almost to complete pelvic eviscerations. These long and severe operations are possible only because of the advances already mentioned such as the generous use of blood transfusions, better anesthesia and the miracle antibiotics. Yet in a sense they are reversions to an early period in the development of abdominal surgery when very radical operations for cancer were undertaken. The excessive mortality of those operations at that time led surgeons to become much more conservative. If they had had the auxiliary measures which we possess, doubtless the surgical attack on cancer would have continued to be exceedingly radical. The modern tendency, however, is even more bold and extreme than that of our forebears.

The application of principles of endocrinology has had some success in the treatment of malignant disease of the sexual organs. Huggins has shown the beneficial effect of orchiectomy in the treatment of cancer of the prostate. Likewise in some cases of cancer of the breast the removal of the influence of the ovaries by x ray or surgical sterilization has seemed to delay the progress of the disease and to assist in the calcification of bone metastases.

Progress during the decade in some of the special fields, such as neurosurgery, orthopedic surgery and urology, has not been discussed because representatives of those fields would be more competent than the writer to present the subject.

In what directions will the next decade go?

—EVARTS A. GRAHAM.

Psychology of Surgical Patient is discussed by Alexander Kennedy[1] (Univ. of Durham). Because the mature surgeon has considered all the surgical pathologic and human factors which may affect the outcome he sometimes obtains a better functional result than a junior colleague whose theoretical knowledge and operative technic are more polished. Transient unhappiness, ungrounded fear, uncertainty and laziness are the surgeon's legitimate concern. Their pathologic counterparts, depression and anxiety, need expert assessment.

Patients are far more impressed by what the surgeon says to them, how much he hurts them and how much he appears to understand their individual difficulties than by the most skilful arts he can practice on their unconscious bodies. They reinforce their faith in him by glorifying him in conversation and interpreting his most trivial sayings as those of the man of steel they inwardly hope him to be. The strong emotions involved in this relation are of positive value in eliciting the patient's co-operation. When a discouraging disability has to be faced, the method of revealing it to the patient requires great care to maintain morale at its highest and with it the will to co-operate in re-educative treatment. Caution is necessary in the use of medical terminology, such as the word chronic, for example, lest it clash with the perverted nomenclature of hearsay and commerce. In speaking to patients with a poor prognosis a faint ray of hope is so much better for morale than an inactive pessimism that the latter is rarely justified unless to make the patient put his affairs in order in the interests of his family.

Hospitalization involves translation into a world where almost every detail of daily routine differs from that to which the patient is accustomed. Appreciation of these difficulties will help him adapt himself to his new surroundings. Management of patients hospitalized for a long time requires great care not only because of the inevitable fluctuations of morale but because of their tendency to become

(1) Brit. M. J. 1:396-400, Feb. 18, 1950

GENERAL TOPICS

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tract Tachycardia in a patient with a good exercise tolerance may suggest hyperthyroidism, the patient may develop a thyroid crisis after an operation.

Postoperative problems are few if patients are carefully selected Postoperative tachycardia (or auricular fibrillation) must be differentiated from shock or hemorrhage. An inquiry about previous attacks or an ECG may be of value. The attacks usually subside spontaneously An ice bag on the precordium sedation and reassurance may be of value. Postoperative coronary thrombosis is uncommon

If cardiac competence is questionable, excessive postoperative administration of intravenous fluids is contraindicated

Preoperative and Postoperative Care are discussed by Frederick A. Coller and Marion S DeWeese[3] (Univ of Michigan) The first step in preoperative preparation is accurate evaluation of the patient's physical and mental status, so that a proper plan may be initiated for correction of pathologic conditions If adequately prepared and understandingly managed, both the young and the old tolerate major operations well.

Nutritional preparation is best carried out by the normal route whenever possible, utilizing diet sufficient in all food elements Progress in restoring deficiencies can be followed by a careful recording of the daily intake especially of protein and calories The oral route is inadequate if there is pronounced esophageal or pyloric obstruction. Such cases present a particular problem because feeding by other routes has only limited usefulness Parenterally administered protein is helpful in severely malnourished patients who cannot take adequate diets in other ways. If protein supplies are limited hemopoiesis has top priority A rational program includes whole blood first and adequate protein and caloric intake later A normal hemoglobin level is essential for maintenance of adequate oxygenation during and after anesthesia It aids chronically ill patients in tolerating surgery and can be achieved by multiple whole blood transfusions Since vitamin C is essential for wound healing as much as 1 Gm daily should be given. Thiamine hydrochloride (10 mg daily) riboflavin (2 mg) and nicotinic acid

(3) J A M A 141 641-646, Nov 5 1949

(50 mg daily) aid in carbohydrate metabolism Utilization of parenterally administered dextrose especially demands these vitamins. Riboflavin also aids in the utilization of certain amino acids. Vitamin K should be given when there is hepatic insufficiency, gastrointestinal lesions producing obstructive jaundice, diarrhea or persistent vomiting or when intestinal antiseptics are being used. Severe operative hemorrhage may result in a prothrombin deficiency

Treatment of dehydration and chemical imbalance consists in administration of appropriate volumes of Ringer's solution and/or 5 per cent dextrose in water Sodium chloride solutions alone correct the simple alkalosis of pyloric obstruction. Acidosis may be treated with solutions of sodium lactate or in the presence of hepatic insufficiency with sodium bicarbonate Dosages must be judged by clinical response. Daily total volume and specific gravity of urine best reflect water needs. With normal renal function and adequate urinary output (1,000-1,500 cc) determination of urinary chlorides provides an index of further sodium chloride requirements These chemical abnormalities require immediate correction before operation

With intestinal obstruction no definitive operation should be performed electively until decompression has been effected Obstructions of the pylorus and of the upper part of the small intestine are best managed by gastroduodenal (Wangensteen) suction. The Miller Abbott tube is most useful in small intestine obstructions without vascular embarrassment Colon obstruction is best managed by a decompression cecostomy or colostomy in a site dictated by location of the obstruction Intestinal antiseptics such as succinylsulfathiazole phthalylsulfathiazole or phthalylsulfacetimide are a definite aid in preparation of the colon. Orally administered streptomycin should not be given for longer than 48-72 hours because it rapidly loses its efficiency after this time

Replacement of blood simultaneously with its loss during operation is important, but there is no suitable laboratory test which accurately estimates the volume lost. Preoperatively blood volume cannot be raised effectively above normal levels as prophylaxis against subsequent hemorrhage Fluids should be carefully administered parenterally

during operation Water is best supplied in a 5 per cent solution of dextrose more than 1,000 cc is seldom necessary Sodium chloride solutions should not be given. Careful technic, gentle handling of tissues painstaking hemostasis, sharp anatomic dissection and accurate reconstruction contribute immeasurably to postoperative comfort. Within reasonable limits operative time is of secondary importance to operative care

Patients should be urged to get out of bed within 24 hours after operation and aided in walking Renal function is usually depressed during the first 12-48 hours, and administration of sodium chloride places a harmful and unnecessary burden on the depressed kidneys. On the day of operation intravenous fluids should be limited to blood in sufficient quantities to replace that which is lost and a volume of 5 per cent dextrose in water sufficient to replace insensible water loss (approximately 1,500 cc)

Fluid and electrolyte requirements during the remainder of convalescence are dependent on the patient's progress and are determined only after careful clinical appraisal. If renal function is normal, specific gravity and volume of urine is the best index of water need In temperate climates 2 000 cc daily will usually satisfy basal metabolic requirements. The oral route should be utilized as early as possible, but if the parenteral route is used, 5 per cent dextrose in water is the solution of choice Electrolytes should be replaced only as lost and on a volume-for volume basis utilizing hypotonic sodium chloride solution. If anemia has been corrected preoperatively and blood loss replaced during operation postoperative blood transfusions are given only as need arises.

After operations such as colonic resections with primary anastomosis solid foods may be given as rapidly as they are tolerated usually by the second or third day Protein hydrolysate or amino acids should be reserved for patients deprived of the oral or gastrojejunal route for a prolonged period and should not be routinely administered postoperatively Whole proteins given orally are more efficiently utilized than protein hydrolysates administered either orally or intravenously Carbohydrates are necessary for their caloric value and protein-sparing effect The 100 Gm dextrose con

tained in 2,000 cc of 5 per cent dextrose solution is sufficient to prevent significant diversion of proteins to meet energy requirements Caloric requirements must be met as rapidly as possible by oral feedings of carbohydrate and fat. Vitamin requirements are the same as preoperatively, but vitamins should not be given parenterally with protein hydrolysates.

Constant gastroduodenal suction postoperatively is of value in certain instances However its routine use after every abdominal operation is unnecessary indications are development of gastric distention or vomiting Sedatives, particularly morphine derivatives and barbiturates, are often given without justification. During surgical convalescence cathartics and enemas are grossly misused universally If appetizing meals are served rather than potent cathartics given peristalsis will promptly resume normal rhythm

Prevention prompt detection and treatment of complications demand constant attention during the early postoperative period Atelectasis is preventable if the tracheobronchial tree is constantly kept free from secretions Effective measures include enforced cough and hyperventilation, intermittent tracheal suction and bronchoscopy if more conservative methods fail Atelectasis should always be suspected when there is a sharp temperature rise in the first 48 hours Antibiotic therapy is warranted for control of secondary pneumonitis

Early detection of phlebothrombosis is the greatest single aid in reducing incidence of pulmonary embolism. Phlebothrombosis should be suspected whenever there is a simultaneous rise in temperature pulse and respiratory rate The legs should be examined routinely once or twice daily for edema, tenderness in the calf, pain on dorsiflexion of the ankle or distention of superficial veins of the leg The choice between use of anticoagulant therapy and ligation of deep veins of the leg or vena cava is frequently difficult, but prompt treatment is mandatory once diagnosis is made Anticoagulants are favored except in patients with advanced degenerative disease in those with a bleeding hazard or in those who have had repeated or septic emboli during anticoagulant therapy

In a follow up of patients in the cancer group conducted one year later to see whether opinions had changed, 31 answers were received In the interim 2 patients had died and the other 29 replied essentially in the same way as they had in the first questionnaire

[It seems to the editor that the most important question in this regard is whether or not to tell the patient with far advanced, hopeless cancer the truth about his condition. Undoubtedly there are some patients who for business or other reasons prefer to know their true condition and probable life expectancy but most people seem to crave some right to optimism. The patient with a resectable cancer always has reason to expect a possible cure. His situation is entirely different from that of the patient with an inoperable condition.—Ed.]

SURGICAL ARMAMENTARIUM

Preliminary Report on New Method of Intestinal Intubation with Aid of Flexible Stilet with Controllable Tip is made by *Grafton A. Smith* and *Edwin L. Brackney*[6] (Univ of Minnesota) This method facilitates both preoperative preparation of the patient with early obstruction and early nonoperative treatment

APPARATUS —The stilet (Fig 1) consists of a controllable tip 1½ in. long made of a flat spring enclosed within a coiled spring Two fine wires attached to the point of the controllable tip pass on either side of the flat spring inside the coiled spring and on into the inner coil of the stilet. The inner coil (5 in long) is a coiled flat wire. It is of light construction and forms a flexible column through which the fine wires pass from the controllable tip to the body of the stilet. The body is a more heavily constructed coil spring (4½ ft. long) through which pass the two fine wires from the tip and a third wire, which is attached to the junction of the body and inner coil. The handle is attached to the body The wires from the controllable tip traverse the handle and are attached to the large lever which when moved through a 60 degree angle from the midposition places tension on one wire, turning the controllable tip through a 90 degree arc to the same side. Moving the lever arm to the opposite side points the controllable tip in the opposite direction The thumb lever on the side of the handle is attached to the third wire and pressure on it tightens this wire, stiffening the body of the stilet

The tube is 9 ft. long made of Koroseal with a small Lucite plug cemented into its end. On each side of the plug is a hole which connects with the lumen of the tube. A latex balloon is tied onto the

(6) Surgery 27 817 821 June 1950

tubing just behind the Lucite plug and a small plastic tube is attached to inflate the balloon. A hole is cut in the wall of the tube 4 ft. 0 in. from the balloon to admit the stilet. This hole is later plugged by a small metal tubing insert. The stilet is easily inserted and extracted from this tube.

PROCEDURE.—The tube and stilet are lubricated with instrument oil, and the stilet is introduced through the hole in the side of the tube to 1 in. from the Lucite plug. The patient lies supine on the fluoroscopy table and the stomach is distended with 800-1,000 cc. air, using a Wangensteen duodenal tube. The tube with stilet in

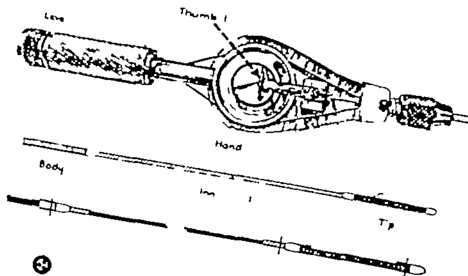


Fig. 1.—Flexible stilet with controllable tip. (Courtesy of Smith, G. A., and Brackney, E. L.: Surgery 27: 817-821, June 1950.)

place, is introduced through the mouth or nose into the cardiac portion of the stomach. The controllable tip is turned to point to the patient's right, and the tube and stilet are advanced along the greater curvature of the stomach until the end of the tube lies at the pylorus. The controllable tip is then manipulated until there is no curve. Pressure is made on the thumb lever to stiffen the body of the stilet, and the tube is advanced into the duodenum. The stilet is withdrawn from the tube, the balloon is inflated with 20 cc. air and the hole in the side of the tube through which the stilet was inserted is closed with the metal tubing insert. All manipulations are done under fluoroscopy; the fluoroscope need be on only briefly.

Intubation was successfully accomplished in 22 of 23 patients with moderate to severe intestinal obstruction.

The one failure was due to adhesions about the duodenum from a previous laparotomy. There were 10 patients in whom other methods of intubation had failed. Over-all average time required for intubation was 10 minutes, the shortest being 2 minutes and the longest 30.

Complications of Gastrointestinal Intubation. John S. Chaffee[7] (Erie, Pa.) discusses only complications due to the mechanical pressure of tubes in the digestive tract, dividing them into eight classifications.

Sinusitis and otitis media. The latter occurs especially in children.

Esophageal stricture. This complication may occur after continuous intubation for two to four weeks and should be suspected in patients with dysphagia after prolonged gastric intubation.

Laryngeal obstructions. These obstructions can be insidious or rapid and invariably occur days after the tube has been removed. They are due to pressure necrosis of the esophagus near its attachment to the body of the cricoid cartilage. Warning symptoms are dyspnea, dysphagia, hoarseness, blood-streaked sputum and croupy cough. Tracheotomy is often required and may be permanent.

Knotting of the tube within the stomach. This complication doubtless has occurred more often than reports indicate. The most unusual case reported is one in which a double complex knot of the tube in the duodenum caught against the pyloric sphincter. Since the tube could not be withdrawn, it was divided as far down the pharynx as possible. The entire tube and knot (3 × 5 cm.) passed spontaneously at the anus 48 hours later. Chaffee reports two cases in which the tube was tied in a single knot 1 in. and 4 in. from its tip and was withdrawn with moderate effort.

Rupture of esophageal varix. Chaffee reports a case in which this complication occurred in a patient with cirrhosis of the liver. Review of the literature failed to reveal an article or case report dealing with rupture of an esophageal varix from a tube in the esophagus. The accident occurred after seven days of intubation, and the patient died of exsanguination 36 hours after onset of hemorrhage.

Ruptured viscus. Rupture of the esophagus, stomach and

(7) Am. Surg. 130:113-123, July 1949.

small intestine has been reported Chaffee reports a case of gastric carcinoma in which the stomach was prepared for two days preoperatively with continuous Levin tube suction and gentle lavage with normal saline solution At operation, a perforation about 8 mm in diameter was found on the anterior aspect of the stomach through the midst of the tumor through the perforation the tip of the tube was just protruding into the peritoneal cavity In view of this experience one should make it a rule to be sure that the tip of the tube changes position in relation to the gut daily

Inability to withdraw the balloon tipped tube Patency of the air channel of the tube and free communication with the balloon should be determined daily If there is any doubt whether the balloon is deflated or if any resistance is encountered in withdrawing the tube forcible pull should never be used A roentgenogram will determine whether the balloon is collapsed Early laparotomy and puncture of the balloon through the intestinal wall with a needle have been suggested if the tube passes to the lower intestine and the balloon does not deflate For a mercury filled balloon which has passed beyond the ileocecal valve cutting the tube to allow elimination at the anus has been recommended

Breakage of mercury filled bag No ill effects have been reported from this accident

Use of Slowly Absorbed Suspension of d Tubocurarine Chloride in Traumatic Injury Regardless of the severity or extent of acute traumatic injuries John D Fuller[8] (Santa Cruz, Calif) believes that muscle spasm is often the symptom which causes the patient the greatest distress. A microform emulsion of pure d tubocurarine alkaloid in a repository menstruum containing 25 mg of the drug/cc has been used successfully to overcome this spasm. In 24 consecutive injections, absorption was sufficient to relieve muscle spasm and pain within 45 minutes, and this clinically effective level was maintained 12 24 hours. There was no pain or discomfort at the injection site or any unpleasant subjective manifestations of curarization Dosage was calculated

(8) J A M A 143 789-791 July 1 1950

on the basis of 4.464 mg d tubocurarine chloride/kg body weight.

Use of Hyaluronidase in Preventing Pain of Subcutaneous Heparin Injection is described by M. S Tuchman and S E. Moolten[9] (New Brunswick, N J) In 12 patients intermittent subcutaneous injections of hyaluronidase heparin provided rapid and maximal dosage effect under maximal control with minimal discomfort to the patient.

METHOD.—Sterile hyaluronidase was dissolved in saline so that 0.5-1.0 units was contained in 1 ml. Before each heparin injection, 5 ml hyaluronidase solution was infiltrated subcutaneously at the chosen site. Hyaluronidase injection was done slowly, without undue pressure on the syringe plunger, using a 23 or 24 gauge needle inserted rather deeply The needle was left in situ. As much as 10 ml. heparin solution containing 10 mg./ml. was injected. A site previously utilized could be used again for reinjection of heparin two or three times in succession in 12 hours without giving additional hyaluronidase.

Absorption rate and coagulation time curves obtained were almost identical with those produced by intermittent intravenous administration of heparin at the same intervals and in similar dosage The procedure is relatively simple and easily carried out by the nursing staff. Hyaluronidase infiltration was effective in one case in aiding in rapid absorption of a large painful hematoma.

Tissue Reactions to Tantalum Mesh and Wire in dogs and rabbits were studied by Amos R. Koontz and Robert C. Kimberly[1] (Johns Hopkins Univ) Tantalum mesh placed next to bowel in closing experimentally produced abdominal defects caused a few omental adhesions to the inner surface of the mesh but no bowel adhesions. When the omentum was removed and the experiment repeated, adherent bowel could be easily separated from the mesh and there was no evidence of obstruction or of any other untoward effect There was no migration of the tantalum mesh when it was implanted without suture fixation. Mesh should rarely be implanted under tension but if this is done the edges should be turned under so that sutures will be placed through two layers of mesh instead of one Mesh may be fixed in place with silk sutures, but this should be avoided if there is any tension, for the sutures might be cut through. In many experiments in which there

(9) Am. J M. Sc. 219 147 151 February 1950
(1) Ann. Surg. 131 666-686 May 1950

was no tension, silk held perfectly and worked as well as tantalum wire sutures When mesh was sutured in place with steel wire there was no evidence of loosening of the sutures or unfavorable reaction due to contiguity of the two different metals. Good healing may be obtained after implantation of tantalum in a grossly infected region Braided tantalum wire despite its interstices, is as resistant to infection as monofilament tantalum wire Use of silk in infected regions invites formation of persistent sinuses. Tantalum mesh is much more resistant to infection than stainless steel mesh. A prompt striking fibrous reaction followed placement of tantalum mesh in a defect This may be due to chemical stimulation caused by the mesh or simply to furnishing a supporting mechanical framework for the growth of fibrous tissue More fibrosis occurred around tantalum sutures than around steel but there was more inflammatory reaction adjacent to stainless steel wire than tantalum wire Implanted tantalum mesh produces a normal fibroblastic reaction and a soft, pliable wound, but implanted steel mesh (Dur lov) becomes surrounded with dense scar tissue which does not infiltrate the mesh but produces a hard tumor like effect Fibrous tissue starts growing around and through tantalum mesh almost immediately on implantation, becoming more profuse with time and after two months it is very dense Tantalum mesh implanted in puppies caused no contracture as the puppies grew

Report on Usefulness of Antiseptic Detergent for Preoperative Scrubbing of Skin. Because of several favorable reports, Robert W Painter[2] tested pHisoderm* containing 3 per cent hexachlorophene (G 11) at Hartford Hospital Since the usual preoperative scrubbing technic consisted of an 8-10 minute scrub with soap and water this was compared with the method suggested in previous articles. The efficiency of the scrub was determined by taking cultures of the finger tips on blood agar plates after this the hands and arms were rinsed in 500 cc sterile water for one minute A sample of the rinse fluid was then taken for culture with serial dilutions for colony counts The blood agar plates and the rinse water showed innumerable colonies of Staphylococcus aureus The same scrub was re

(2) J Connecticut M. Soc. 14 301 204 March, 1950

peated on several consecutive days, and the results each day were about the same

A week later the following experiment was carried out. First 2-4 cc. pHisoderm* with 3 per cent G 11 was applied to hands and forearms and cleansing carried on for one to two minutes, with water added. This preliminary washing removes most acquired soil and transient bacteria. Then, 2-4 cc detergent were again applied and the scrub continued for 10 minutes. Cultures were made in the same manner as previously described. After the first scrub there were many colonies on the blood agar plates, but the rinse water showed no growth. In the ensuing days cultures from the fingers showed a gradual decrease in colonies and in no instance was there any growth in the rinse water. Further tests were made cutting the scrub time down to five and even three minutes with little or no growth in any culture. It seemed of particular interest that after the first few scrubs with the detergent finger cultures would often show organisms, whereas rinse water would be sterile. It seems logical to assume that G 11 was acting as a bacteriostatic agent in the rinse water.

[We have used pHisoderm* for more than a year at the Barnes Hospital with satisfactory results.—Ed.]

Tensile Strength of Sutures—*B.P.C. Method of Test*.—D. M. Douglas[3] (Univ. of Edinburgh) states that with the British Pharmaceutical Codex method a straight pull is placed on a single strand of suture material and the strain in pounds recorded at the breaking point. The same procedure is carried out on a suture in which a surgeon's knot is incorporated. This method does not subject suture material to the type of strain which occurs in tissues. Therefore the fracturing strain which operates from within a loop of suture material completed with a knot as in interrupted sutures, was determined. The strain to which continuous sutures are subjected was tested by making an incision in a piece of leather repairing it with a continuous suture and recording the breaking point of the suture material by gradually distracting the incision edges.

Using the British Pharmaceutical Codex method, the mean tensile strength of a single knotted strand of fine silk was 650 Gm., but the mean value for a knotted loop with

(3) Lancet 2: 49 498 Sept. 17 1949

the author's method was 1402 Gm The mean tensile strength of a continuous silk suture was about 10 times the knot strength obtained by the British Pharmaceutical Codex Values for sutures of cotton linen Nylon stainless steel tantalum and silver were also higher

It is desirable to use sutures which have the strength necessary to hold the tissues because the less foreign material left in a wound the more rapidly and soundly it heals Test results suggest that British Pharmaceutical Codex methods of estimating tensile strength of sutures tend to make surgeons use much too heavy suture material

Loss When Implanted in Living Tissue—Douglas[4] tested the tensile strength of various unabsorbable sutures such as are commonly used in repair of hernia They were implanted in the abdominal walls of rabbits and removed at monthly intervals to be tested Silk specimens which had been in tissue for over four months broke into fragments when removed By the seventh month, cotton sutures did not retain enough tensile strength to be of value in a repair By the ninth month linen sutures had a tensile strength of 15 per cent of the control value By the seventh month, Nylon had a mean strength of 84 per cent of the control value The values for stainless steel tantalum and silver remained unchanged

These results indicate that organic suture material can not contribute strength to a hernial repair for longer than a few months whereas sutures of inorganic materials may form a strong and long lasting scaffold on which fibrous tissue repair may develop

Clinical Use of Polyethylene Tubing for Intravenous Therapy Report on 72 Cases is made by B J Duffy Jr[5] (Memorial Cancer Center New York City) Intravenous catheterization with polyethylene tubing alleviated patient's discomfort, was well tolerated and provided considerable patient mobility The tubes were convenient for withdrawing blood samples and for administering blood plasma and hypertonic solutions at a satisfactory rate without difficulty

METHOD—Tubing of sufficient caliber to pass through a no. 17 needle is used for penicillin and heparin therapy tubing which will pass through a no 14 needle is used for blood plasma or protein

(4) Lancet 2 499 501 Sept 1 1949
(5) Ann Surg 12 19 934 November 1949

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(4) Lancet 2 499 01 Sept 3 1949
(5) A Surg 13 [illegible] 936 November 1949

solutions. Intravenous tubing and accessories should be kept as a unit on a small cart which can be transported readily to the bedside. After boiling the plastic tubing in glass tubes to prevent bending, it is stored in a tray containing a 1:1,000 aqueous solution of benzalkonium chloride Because of its low melting point, polyethylene does not withstand autoclaving

An appropriate vein is draped with the usual sterile precautions. A small amount of 1 per cent procaine is given intradermally and subcutaneously and a small incision is made with a no. 5 Bard-Parker blade. A needle is inserted into the vein using a 5 cc. syringe containing 1 cc. heparin, a small amount of which is injected when the needle enters the vein. The syringe is then detached and with the needle carefully held in place the tubing is passed into the vein for a varying length, depending on the site selected. A small amount of heparin is instilled into the tube before insertion The needle is withdrawn while holding the tubing in place with digital pressure. A blunt nosed no 18 needle is inserted into the free end of the tubing and the remaining heparin injected into the tube to prevent clotting. The tubing is best maintained in place with butterfly adhesive and suture tied around it or with elastic adhesive. For infusions a Luer Lok adaptor is attached to the tubing but otherwise the tube may be effectively sealed with a Luer Lok plug

The tubing is rinsed out with sterile isotonic saline after plasma or blood infusions. After each use, or at least twice a day, 0.5-1 cc. heparin should be instilled into the tube. This may be discontinued after four to five days if the tube is being maintained with constant infusions of isotonic aqueous solutions. Changes of the direction and position of the tube may be necessary to permit freer movement of the patient and more ease in infusing and withdrawing specimens through the tube. Blood withdrawal is facilitated by use of a tube with several lateral openings at its distal end. Continuous intramuscular therapy may be given by insertion of the smaller catheter through a long no 17 needle under the fascia lata.

Edema resulted when tubing occluded the vein probably because of mechanical irritation The jugular and femoral veins were the most satisfactory for intravenous catheterization. Intubation was successful in 54 of 72 cases. Results were completely satisfactory in 42 of 48 cases when large veins were catheterized A jugular tube remained patent for 39 days and was removed electively without cor- tions a femoral tube was similarly effective for [illegible] Symptoms of mild phlebitis were noted in 16 [illegible] thrombosis was [illegible] d after 3 8 and 17 days cases in which [illegible] were used

The theoretic[illegible] of aspiration of a[illegible] [illegible]vented by having[illegible] a recumbent

the open end of the tubing below the heart when specimens are withdrawn or infusions started Femoral puncture should be performed carefully to prevent reflex arterial spasm. The femoral route is not used with extensive lower abdominal surgery due to the possibility of further complicating an established phlebitis.

Scale for Rapid Measurement of Blood Which Is Lost in Surgical Sponges is described by Robert E Gross[6] (Harvard Univ) In the operative field he uses only dry sponges

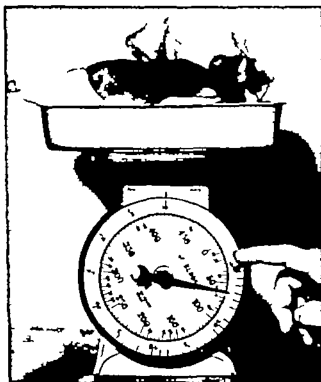


Fig. 2.—Weighing scale in use with 10 blood-soaked sponges in pan for weighing. With a finger face dial is rotated so figure 10 comes opposite arrow at top. Main, central pointer directly indicates that sponges contain 62 cc. blood. (Turning face dial automatically discounts weight of 10 dry sponges.) (Courtesy of Gross, R. E.: J Thoracic Surg 18 543-545 August, 1949)

of a standard commercial variety weighing 8 Gm. and dry pads weighing 40 Gm., the equivalent of five sponges. This makes it possible to use a weighing scale fitted with an adjustable device which can quickly compensate for the number of sponges being weighed.

(6) J Thoracic Surg 18 543-545 August, 1949

APPARATUS AND METHOD —The scale has a dial face that can be turned. The 1 cm. outer rim of the dial is marked off at intervals of 8 Gm. in counterclockwise direction. The body of the scale is fitted with a plate carrying the legend "number of sponges" and a central arrow above the rim of the turntable dial face a pan for the sponges is firmly attached to the platform of the scale (Fig 2) During an operation the circulating nurse occasionally weighs the discarded sponges. For instance, if 10 sponges are placed in the scale pan, she turns the face dial so that the rim number comes to 10 opposite the arrow at the top of the instrument. The pointer hand will then directly show on the inner row of numbers of the face dial the cubic centimeters of blood in the sponges.

The nurse keeps a rough balance sheet. Each time a load of sponges is weighed, the weight of blood is added to the record sheet. To determine total blood loss at any moment, it is enough to glance at the bottom figure on this sheet and mentally add the amount in the suction apparatus bottle on the floor Amounts of blood given intravenously are also noted in an appropriate column on the record sheet

This method is accurate enough for practical purposes indicating the minimal amount of blood that must be replaced

SHOCK—BLOOD VOLUMES

Changes in Volume of Plasma, Interstitial and Intracellular Fluid Spaces during Hydration and Dehydration in Normal and Edematous Subjects were studied by Samuel E. Leard and Edward D Freis[7] (Boston Univ) Neither plasma volume nor intracellular fluid volume are static during changing hydration. During dehydration in normal persons, about 25 per cent of the loss of total body water was contributed by plasma 25 per cent by interstitial fluid and 50 per cent by intracellular fluid. In patients with gross edema, similar dehydrating procedures caused loss of body water of which about 5 per cent was supplied by plasma, 85 per cent by interstitial fluid and 10 per cent by intra cellular fluid Despite the different percentages contributed by the different compartments, the absolute amount of fluid lost from each was about the same in both normal and edematous subjects. With the greater diuresis in edematous

(7) Am. J Med 7 447-454 November 1949

persons, as compared with that in normal persons plasma volume must contribute a smaller percentile loss to the fluid depletion of edematous persons to prevent excessive hemoconcentration

When normal persons were overly hydrated with excess salt and desoxycorticosterone acetate interstitial fluid took up relatively large amounts of water Plasma volume gain averaged 12 per cent of the increase in total extracellular space although the absolute increase in plasma volume was similar in amount to the reduction occurring during dehydration of normal persons The intracellular fluid volume decreased during this period After injection of mercuhydrin,* there was a specific reversal of the desoxycorticosterone acetate effect with a return of plasma volume thiocyanate space and body weight to approximately pretreatment values These changes toward normal indicated an apparent shift back into the intracellular space of fluid previously lost to the extracellular compartment

Although plasma volume and intracellular fluid space appeared to fluctuate in both normal and edematous patients with changes in hydration, the absolute amount of change in these fluid compartments appeared to be relatively constant under the conditions of the experiment

Controls in Treatment of Burns are discussed by Thomas F Rose[8] (Sydney) The neurogenic shock of burns is best treated by intravenous injection of morphine Adults with burns involving 10 per cent or more of body surface and children with burns involving 5 per cent or more require intravenous medication to prevent or treat oligemic shock. If treatment is required, infusion of 1 L. plasma is begun at once while this is being given blood is typed and cross matched in preparation for transfusion. Since numerous transfusions may be needed, Rh grouping is mandatory Urinary chlorides should be measured and saline given intravenously to assure minimal excretion of 3 Gm. NaCl/L urine a day As much as 15 L. fluid may be required in the first 24 hours in severe cases. In addition to parenteral therapy if the patient is not vomiting fluids may be given orally Fluid intake and output should be measured, the

(8) M. J Australia 41 45 Nov 19 1949

chest examined frequently and plasma proteins measured to prevent excessive fluid administration

Blood transfusions and oral protein feedings should be used to prevent or treat protein loss from the burned area. Patients with burns covering 20 per cent of the surface require 300-400 Gm. protein a day with a 5 000 calorie diet. Protein for oral feeding may be obtained from dried skim milk and is easier to take than amino acid mixtures. If oral feedings cause vomiting and gavage is unsuccessful, intravenous protein therapy with protein hydrolysate, serum or whole blood may be substituted

Avoidance of infection is of prime importance after management of the shock period No pathogens must be allowed to reach the wounds during or between dressings sources of infection must be eliminated and raw areas epithelized quickly utilizing grafting if necessary Rose stresses the infection preventive values of a burns unit with single rooms and its own air-conditioned operating room

As soon as the patient is hospitalized a prophylactic course of penicillin should be started parenterally The burned area is covered with tulle gras, and pressure bandages of cotton wool are applied under aseptic operating room conditions The area is not washed and blisters are not opened If shock is so severe that the pressure bandages cannot be applied, the burns are merely covered with sterile sheeting and the bandages placed later The dressing is not disturbed for 7 10 days and then changed in the operating room If it is obvious from the beginning that the burn is of full thickness, it is treated with wet dressings. If the area is infected, cultures are made and penicillin cream or penicillin-sulfanilamide powder applied locally When bacteriologic reports are available appropriate antibiotic therapy is instituted.

When the dressings are removed 7 10 days after initial application the burn, if superficial, will be completely epithelized In deep partial thickness burns, flat pink granulation tissue will be present. Sheet grafting by means of a Padgett dermatome should be carried out. If there is question of infection in the area to be grafted, it is redressed without grafting If burns are very large grafting may have to be done in sessions Early grafting stops protein loss, infection fibrosis and joint contracture Grafting is

tify vascular stasis on pathologic section The difficulty is no doubt due to the series of dehydrating chemicals to which tissues are exposed before they reach the slide When photomicrographs of normal skin and of that taken 24 hours after a burn are compared the latter shows what pathologists have described as congestion. The authors' studies suggest that vascular stasis existed in the burned skin but the slides are difficult to interpret and do not clearly demonstrate the process seen in vivo

Present Status of Adenine Nucleotides in Bodily Response to Injury H. N Green and H B Stoner[1] (Univ of Sheffield) state that shock produced by intramuscular or intraperitoneal injection of adenosine triphosphate is similar to ischemic shock, except that the heart rate falls earlier and more profoundly and there usually is dilatation of renal vessels In both types, magnesium ions greatly increase or accelerate the severity of symptoms and reduce the amount of insult necessary to cause death Clotting factors accelerate the shock inducing action of adenosine triphosphate but do not influence ischemic shock *Quinine* and mepacrine have a striking prophylactic action in nucleotide shock but fail to show a similar action in ischemic shock. Such data indicate that the nucleotides may be involved in naturally occurring shock, but conclusions cannot be drawn

In the rabbit various injuries were accompanied by a significant increase in the adenosine equivalent of whole blood This increase was similar to that which occurred after intramuscular injection of a fatal dose of adenosine triphosphate Experimental ischemia of both legs in man was followed by an increased adenosine equivalent of whole blood Battle casualties had plasma inorganic phosphorus fractions elevated in proportion to the amount of damaged tissue The source of excess nucleotides and their derivatives in the blood is probably the damaged tissue itself particularly muscle Although erythrocytes contain large amounts of nucleotide, the increased adenosine equivalent in whole blood cannot be correlated with the degree of hemolysis in shock.

Other metabolic factors may be concerned in the mechanism of traumatic shock Other nucleotide components such

(1) Brit. M J 1 05 809 Apr 8 1950

as inosine adenylic and inosinic acids and ribose phosphate do not usually have a shock inducing action except in the presence of excess magnesium. There is an increased magnesium content in plasma with ischemic shock the source probably being damaged tissue The possibility of this or other potentiating agents affecting not only the biologic activity of adenosine triphosphate but in particular its derivatives must be kept in mind

Certain Aspects of Nature and Treatment of Oligemic Shock. Irvine H Page[2] (Cleveland) states that all investigators agree on one fact shock represents all-embracing dissolution. Therefore its over all effects can probably best be measured by a quotient representing cardiac output and oxygen consumption as a measure of effective blood flow Gesell has most nearly approached this concept within his "nutrient flow" Whether the lack of one specific element such as oxygen, is at fault chiefly or whether many substances are involved is not known It is therefore probably unwise to continue to use the terms anoxia or hypoxia exclusively to explain the cause of the tissue changes Whatever the mechanism widespread tissue ischemia of sufficient persistence results in shock. Clinicians probably realized first that oligemia was important as a cause of shock, but they did nothing more than attempt to measure it by the uncertain hemoglobin and hematocrit methods However much critical work has been done by some authors and their observations, with low blood pressure give the picture of the state of affairs early in shock. Oligemia may be given primacy and the other changes follow Then begins the period of generalized dissolution in which so many chemical reaction paths are disturbed as to leave the investigator baffled

In treatment of shock blood volume must be restored to normal as rapidly as possible Among the reasons for giving blood by artery instead of by vein are (1) blood pressure is restored to normal in a few minutes and the pressure is controllable (2) blood volume deficits are automatically corrected (3) when heart and respiration have failed, blood given into an artery often resuscitates

The apparatus required consists of a pressure reservoir

(2) Am. Heart J 35 161 182 August, 1948

with manometer connected to the femoral or radial artery (Fig 3) If the need is urgent, an 18 gauge needle may be inserted pointing toward the heart, or if time permits a glass cannula may be tied in. Heparin solution is used to prevent coagulation in the cannula and tubing but the blood in the reservoir may be citrated unless large amounts are to be given, when heparin becomes more desirable. Murphy drips or any contrivance that might trap air are

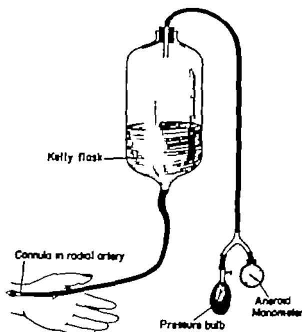


Fig 3—Simple apparatus for emergency arterial transfusion. (Courtesy of Page I. H Am Heart J 38 161 192 August, 1949)

carefully avoided. In practice, if the blood pressure is 30 mm. Hg or less, the pressure in the reservoir should be set 20 mm higher and blood allowed to flow in The pressure is then raised in increments of 20 mm. until the systemic pressure is 100 mm. When blood is given by artery the amount required to restore arterial pressure is little more than half that needed when blood is given by vein. In case of emergency it is immaterial what fluid is given to maintain the circulation until the more suitable blood is available

It has been noted that at low systemic pressures blood flows retrograde up the aorta and perfuses the coronary and medullary vessels This seems to explain why it was possible to resuscitate, with a combination of intra arterial infusion of blood and epinephrine and artificial respiration, animals in which circulation and respiration had ceased 84 per cent were resuscitated 51 per cent lived an average of 10 hours and 33 per cent survived indefinitely apparently unharmed In patients, it was possible to locate bleed

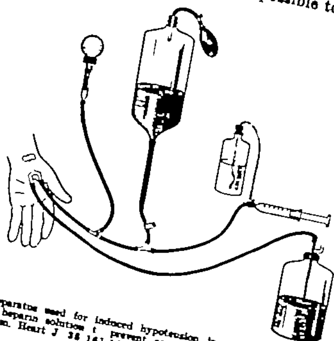


Fig. 4 —Apparatus used for induced hypotension in patients. Syringe and small bottle contain heparin solution t prevent coagulation in the tubing. (Courtesy of Page I. H.: Am. Heart J 38 161 192 August 1949)

ing vessels in the abdomen which no longer bled when the pressure had fallen to a low level when the pressure was raised for a minute or so blood spurted from the broken vessel, allowing its ligation Gardner has used the procedure in about 50 patients to reduce the risk of severe blood loss during cranial operations with Hale he has transferred about 2 L. blood to reservoir bottles and reduced the blood pressure to 80 or 90 (Fig 4) at which level bleeding in the brain is greatly reduced and operation facilitated. Operating time may be reduced to less than half and blood loss is insignificant Before the cavity is closed the pati

again receives all but 500 cc of his blood which may be given later intravenously if needed

[The idea of deliberately reducing the blood pressure by withdrawal of blood immediately preceding or during an operation comes as a shock to those habituated to the plan of maintaining the blood pressure at as nearly the normal level as possible Yet the proof of the pudding is in the eating, and Gardner and Hale seem to have demonstrated that the plan has merit. —Ed.]

Evaluation of Oxygen Therapy in narcotized dogs was made by Philip B Price Ralph C Richards and James B Hammond[3] (Salt Lake City) In one group of dogs shock was produced in different ways, but in none, either during early or late shock, was administration of oxygen followed by apparent clinical improvement or sufficiently increased oxygen uptake When central circulatory failure was produced by cardiac tamponade oxygen did not improve the animals clinically and did not increase oxygen consumption In a third group respiration was embarrassed by tracheal obstruction prolonged inspiratory resistance pneumothorax and hydrothorax, central respiratory depression with morphine or external pressure on thorax and abdomen. Pure oxygen was of no appreciable value in the absence of cyanosis. With slight cyanosis, oxygen gave relief but oxygen consumption/minute was not increased With severe respiratory dysfunction, oxygen decreased cyanosis and significantly increased oxygen uptake Several dogs in late stages of shock with coincident hypotension and respiratory embarrassment, died suddenly when pure oxygen was given

These observations indicate that in states of shock, when respiration is unimpeded oxygen is of dubious clinical value In such cases restoration of adequate circulation is the only way to correct the anoxia of shock. In cardiac tamponade also and presumably in other forms of cardiac failure if there is no associated respiratory hindrance such as pulmonary edema oxygen has limited value until the central circulatory failure is corrected. On the other hand, if free and normal respiration is seriously interfered with, oxygen is almost always indicated When circulatory failure and respiratory difficulty coexist, oxygen should be

(3) Am. Surg 130 747 754 October 1949

given with caution combined perhaps with judicious use of carbon dioxide

[Of course to be effective the oxygen must get to the cells. The mere administration of it to the lungs can hardly be effective if there is no adequate mechanism for carrying it from there to the cells of the body All of this reminds one again how curious it is that our bodies have no means of storing available oxygen to be used in an emergency although provision is made for storing practically everything else that the body needs.—Ed.]

Blood Volume in Surgical Disorders was studied by W C Wilson[4] (Univ of Aberdeen), using the dye hematocrit method (T 1824) Dilution begins as early as 30 minutes after hemorrhages of less than 540 ml., becomes well advanced in 2 hours and is usually complete in 24. The diluting fluid is somewhat deficient in protein and some of it passes into red cells There is no evidence that a significant number of red cells is added to the circulation When larger amounts of blood are lost, the diluting process is even more delayed. When 30-50 per cent of blood volume is lost, peripheral resistance is raised by widespread vasoconstriction, blood pressure and cardiac output are low and the arteriovenous oxygen difference is increased. Without transfusion severe acidosis and other features of stagnant anoxia occur

In peritonitis there is a reduced blood volume, mainly in the plasma component, a parallel reduction in total circulating protein and a disproportionate fall in total circulating albumin. Laboratory tests show evidence of impaired renal and liver function. Volume and protein deficits may be speedily corrected by intravenous infusion but the total circulating albumin deficit may persist for weeks Liver function is quickly restored by treatment, but kidney function remains disturbed for days. Plasma volume is reduced in peritonitis because of plasma exudation into the inflammatory zone and ileus, with large fluid and salt losses The initial disappearance of red cells may be explained by stagnation of some part of the vascular bed, but the later decline in cell volume may be partly due to extravasation and loss of cells into the bowel. When peritonitis develops slowly over several days plasma volume may be reduced by 30 per cent or more without a fall in blood pressure, suggesting adaptation of the organism to a reduced blood vol

(4) Edinburgh M J 57 30 43 January 1950

ume In fatal peritonitis, normal blood volume is often not restored by infusion. Renal disturbances in peritonitis may be attributed to vasoconstriction and tubular damage The role of bacterial intoxication in producing renal damage is uncertain In late strangulation of large segments of bowel, circulatory disturbance responses to treatment are similar to those in severe peritonitis In these patients it is better to resect nonviable and doubtfully viable bowel, even if the patient is desperately ill than to return it to the peritoneal cavity

At operation there is a fairly close relation between blood loss and decreased blood volume With large blood losses, volume fall tends to be greater than blood loss Transfusion is desirable when during operation there is loss of 18-24 per cent of blood volume and becomes imperative after loss of 23 28 per cent of blood volume The mechanism by which hemorrhage produces shock is unknown but responses of the smallest blood vessels may alter blood flow in the peripheral circulation seriously retarding it

Blood and "Available Fluid (Thiocyanate) Volume Studies in Surgical Patients Operative and Postoperative Blood Loss with Particular Emphasis on Uncompensated Red Cell Loss. To measure blood loss of various operations, Joseph R. Stanton, Richards P Lyon, Edward D Freis and Reginald H. Smithwick[5] (Boston) used the gravimetric and colorimetric methods, and repeated pre- and postoperative determinations of red cell volume computed from plasma volume (T 1824 method) and hematocrit reading

Operative blood loss measured by the last method may be considerably higher than that obtained by the first two methods because the amount of blood removed from the wound at operation may be less than the actual amount lost from the circulation. The colorimetric method contains a source of error in that it is based on hemoglobin determinations which may be vitiated by errors in reading and in the process of dilution by incomplete extraction of the hemoglobin from the sponges and by contamination of sponges with bile and iodine The gravimetric method, although yielding more reliable results is also subject to certain errors due to absorption of tissue fluid by the

(5) Surg Gynec & Obst 89 161 190 August, 1949

sponges and presence of fat. In contrast the red cell volume method measures the total volume of blood in circulation, and serial measurements reveal the total amounts of blood lost from the circulation as a result of operation, including that in the surgical specimen and infiltrated into the wound and surrounding tissue spaces or immobilized in vessels proximal to ligatures The method is particularly satisfactory when large amounts of blood are lost it is useful in measuring progressive loss and total depletion of red cell volume and in evaluating replacement therapy The chief difficulty is that it requires special apparatus and faultless technic

Observations showed that further blood loss in the postoperative period may exceed the operative loss by 100-200 per cent Owing to the insidious nature of postoperative blood loss, clinical signs may be absent. Severe uncompensated depletions of red cell volume are replaced only over a period of weeks. This is in contrast to the rapid restoration of plasma volume and total circulating protein which, in the adequately hydrated patient, may be restored to or above control values in one to three days Therefore since plasma and cells are lost in the same proportion as they are present in the blood at operation the hematocrit value on blood drawn immediately after surgery may be essentially unchanged from the preoperative one However after restoration of plasma volume the actual red cell loss becomes fully apparent in the decrease in hematocrit level on the third postoperative day Large decreases in hematocrit level at this time serve as a rough index of the extent of depletion of red cell volume and as a guide to replacement.

Clinical Use of Human Blood and Its Derivatives Present and Future Problems To be prepared for a possible national emergency John B Alsever[6] (Washington, D C) recommends developing blood programs on a nationwide basis, with some national co-ordination and control. In this regard the American National Red Cross has undertaken to support and assist in state regional and local blood programs.

It is most difficult to estimate the number of donors required in a statewide program but studies based on the

(6) Connecticut M J. 14 194 200 March, 1950

donor's blood (3) if advisable, 0 5 1 cc of 1:2,600 epinephrine hydrochloride solution can be added to the blood, (4) an antihistamine can be given the patient orally or intravenously and (5) additional treatment as found necessary can be carried out If, despite these precautions, the patient exhibits allergic symptoms, a suspension of washed erythrocytes instead of whole citrated blood is administered, and frequently the reaction will not appear Despite the reaction, the desired effect is obtained from transfusion.

A circulatory reaction generally is encountered in patients with a chronic cardiac disease As a rule it is due to overloading of the circulatory system, and prognosis must be guarded Inhalations of oxygen under pressure are indicated It may be necessary to withdraw as much blood as was administered. Recovery may be spontaneous.

A hemolytic reaction is one of the most serious complications encountered by physicians. Clinical manifestations generally are characteristic If the reaction occurs on the operating table with the patient under general anesthesia, it is much more difficult to recognize A blood sample withdrawn early in the reaction should show considerable free hemoglobin in the serum A sample of urine passed after transfusion of incompatible blood is smoky red because of hemoglobin. Donor's and patient's blood should be retested for grouping Rh factor and cross matching The exact mechanism responsible for this reaction is not completely understood. The following steps must be taken Transfusion should be stopped the patient must be supported in shock, transfusion of known compatible blood plasma or serum is in order the patient should be alkalinized with 5 per cent solution of sodium bicarbonate or M/6 sodium lactate solution daily intake and output of fluids must be watched carefully 2,000-3 000 cc fluid/24 hours should be adequate the patient should not receive too much salt aminophylline, human serum albumin or blood plasma may be given to encourage diuresis if the patient becomes oliguric or anuric and the nitrogenous waste products are increasing peritoneal lavage may be considered.

For undetermined reactions treatment must be symptomatic

[There is considerable doubt about the value of alkalinizing the urine —Ed.]

Myocardial Intolerance to Excessive Blood Transfusion. William D Holden, Jack W Cole and A. Frank Portmann[8] (Cleveland) have seen several patients die as a result of overenthusiastic use of blood The clinical picture included hypotension which became progressively worse as more blood was given, cyanosis, distention of superficial veins and preoperative evidence of a damaged myocardium. A large dilated heart, a remote myocardial infarct or severe arteriosclerosis of the coronary arteries and venous distention were the only constant autopsy findings The authors cite a typical case

Man, 69, with intermittent precordial pain induced by effort or excitement, lost only a small amount of blood during operation for tumor of the esophagus but nevertheless was given 3,500 cc. whole blood and 300 cc. normal saline. When returned to the ward, the blood pressure, pulse and respirations were high he was cyanotic and the superficial veins were distended. He died 90 minutes later Autopsy showed arteriosclerosis with stenosis of the coronary arteries, a healed myocardial infarction of the posterior and lateral walls of the left ventricle, acute passive hyperemia of the lungs and edema, acute passive hyperemia of the brain, acute hyperemia of the kidneys and chronic pyelonephritis.

The circumstances of such deaths led the authors to attempt to determine whether dogs with a damaged myocardium tolerated large quantities of blood less satisfactorily than dogs with a normal myocardium. Experiments demonstrated that a heart with reduced myocardial reserve will not tolerate the load placed on it by a circulating blood volume that has increased rapidly It may be presumed that considerably less blood, relatively speaking, than was used in the experiments might produce the same results in a human subject whose myocardium is damaged by diffuse vascular disease The most impressive observation was in a group of animals with a large myocardial infarct a state of progressive hypotension bradycardia and elevated central venous pressure preceded death. Animals in this group had severe pulmonary hyperemia and hemorrhage but no free blood in the peritoneum. These findings were reversed in a group with a small area of fibrosis and suggest myocardial failure of the left ventricle in the other animals

Use of blood transfusion as a prophylactic measure against operative shock which may not and, in most in

(8) Surg., Gynec & Obst. 90 455-460 April, 1950

stances, should not exist is not to be condoned Many patients with diffuse coronary arteriosclerosis do not have sufficient myocardial reserve to withstand the rapid increase in circulating blood volume that administration of several liters of blood entails

Acute Coronary Insufficiency Due to Acute Hemorrhage Analysis of 103 Cases was made by Arthur M. Master Simon Dack Henry Horn, Bernard I Freedman and Leonard E. Field[9] (Mount Sinai Hosp., New York City) The gastrointestinal tract was the commonest source of bleeding the most frequent etiologic factor was peptic ulcer There were clinical or electrocardiographic signs of acute insufficiency in 59 patients The effects of hemorrhage caused the death of 22 patients, 18 of whom had clinical or electrocardiographic signs of acute coronary insufficiency At autopsy 4 of 13 patients were found to have myocardial necrosis in the absence of recent coronary artery occlusion

Hemorrhage is of grave significance in patients whose coronary circulation is impaired by coronary arteriosclerosis, aortic stenosis or enlarged heart It may produce myocardial ischemia with detectable evidence of acute coronary insufficiency In this series clinical evidence of coronary insufficiency included substernal or precordial pain or congestive heart failure In some cases precordial pain was associated with shock, tachycardia and fall in blood pressure, simulating massive myocardial infarction These symptoms and signs were transient and responded rapidly to therapy Significant electrocardiographic changes consisted of flat or inverted T waves, RS-T depression and combinations of these Leads I, II and IV were most often affected. The changes were due to reduced coronary blood flow which resulted in anoxia particularly of the subendocardium

In patients with predisposing factors of coronary insufficiency adequate blood should be administered promptly to prevent or treat the dangerous potentialities of this condition which follow acute hemorrhage

(9) Circulation 1 1302 1317 June, 1950

Fluid Therapy Relation to Tissue Composition and Expenditure of Water and Electrolyte According to Daniel C Darrow and Edward L Pratt[1] (Yale Univ) proper use of water and electrolyte solutions is responsible for saving more lives of seriously ill patients than is the use of any other group of substances. Recent experimental and clinical observations have demonstrated that intracellular fluids undergo fairly rapid changes in composition which profoundly alter the acid base equilibrium of extracellular fluids. Sodium, potassium and chloride are especially important since they seem to determine the water content and acid base equilibrium of extra and intracellular compartments.

Total water requirement is calculated as follows. (1) The caloric production is estimated from the patient's age, weight activity and food intake (2) The area appropriate for the diet, fasting or dextrose feeding is chosen. (3) The urinary volume per 100 calories is obtained for an appropriate urinary concentration, usually at a specific gravity of 1.012 (4) This volume is multiplied by one hundredth of the estimated caloric production to obtain the urinary volume (5) For each 100 calories metabolized, 42 ml. water is required to cover insensible water loss. The sum of urinary volume and insensible water loss gives the water expenditure excluding sweat, stool water and abnormal losses In the absence of abnormal losses or large volumes of sweat, 15-20 ml./100 calories metabolized are added to cover total water expenditure Minimal electrolyte losses in an infant, aged 1, are about 8 mM. each of sodium, chloride and potassium. Average minimal losses for an adult are 2 5 Gm. NaCl and 1.5 Gm K. Somewhat larger amounts should be given since minimal expenditure cannot be anticipated

Hypopotassemia may be recognized by weakness and hypotonia of skeletal muscles progressing to paralysis, dyspnea, cyanosis, abdominal distention, nausea and vomiting cardiac enlargement with systolic murmurs, increased pulse pressure with Corrigan's pulse, elevated venous pres-

(1) J A. M A. 143 365 3 3 May 27 432 439 June 3 1950

sure and signs of cardiac failure Diaphragm and abdominal muscle paralysis and functional disturbances of the myocardium account for the major clinical signs and symptoms. The electrocardiogram (ECG) may show a prolonged Q-T interval (best seen in the precordial lead CR_3) decreased height and inversion of T waves, rounded and prolonged T waves, depression of S-T segment and possible inversion of P waves, extrasystoles and auriculoventricular block. Significant decreases in serum potassium concentration may occur without such characteristic signs or symptoms Flame photometry has made measurement of serum potassium a practical clinical examination. Treatment consists of oral or parenteral administration of potassium salts

Hyperpotassemia may be marked by listlessness mental confusion numbness and tingling of the extremities cold gray pallor bradycardia peripheral vascular collapse rapidly ascending flaccid paralysis without involvement of trunk, head or bladder in a few patients with uremia, and cardiac arrest. As serum potassium concentrations increase, the ECG has peaked T waves, increased duration of QRS complex, increased duration of P R interval leading to auricular standstill, biphasic curve with progressive delay in ventricular conduction and total arrhythmia progressing to cardiac arrest when concentrations are above 10 mM./L. Hyperpotassemia occurs almost exclusively when renal excretion is greatly diminished because of renal disease or oliguria accompanying shock and dehydration. Treatment includes intravenous administration of dextrose to retard the release of potassium from cells. This also promotes absorption of potassium from extracellular fluids by the formation of glycogen. Hypertonic sodium chloride solution may improve circulation and renal function. Intravenous injection of calcium salts may prove beneficial.

Fluid therapy should be based mostly on estimation of changes in tissue composition and rate of expenditure of water and electrolyte Knowledge of the serum bicarbonate level and pH aid in evaluation of acid base equilibrium. They are always considered in relation to respiratory rate and depth in order to estimate the efficiency of exchange of gases in the lungs. Serum concentrations of bicarbonate and chloride or sodium show whether fluids are hypo or hyper

tonic Body weight is the most reliable evidence of change in body water from day to day and should be determined accurately in all patients Measurement of urine volume and other excreta is often necessary before deciding the kind and amount of fluid to be administered Restoration of circulation in shock is essential.

Parenteral water is most effectively given by intravenous injection of 5 or 10 per cent solution of dextrose in water Sufficient dextrose to produce maximal protein sparing, eliminate ketosis and conserve extracellular fluid is furnished by 100 cc of 5 per cent dextrose/100 calories metabolized. Except during the first 24 hours of treatment when a large deficit of electrolyte is being replaced the total mixture should not contain more than one third isotonic sodium chloride solution

K lactate a solution developed by Darrow is useful for replacement of electrolyte It contains 4 Gm. NaCl, 2.7 Gm. KCl and 52 ml. M sodium lactate/L Sodium and chloride are in the ratio of interstitial fluid and the amount of potassium is unlikely to raise the serum potassium to toxic levels when the solution is injected over four or more hours in appropriate amounts. Theoretically and practically 80 ml./kg body weight is the optimal amount required to replace the maximal deficit of extracellular electrolytes. Potassium deficits are often so large that they cannot be restored parenterally in less than six days K lactate may be given subcutaneously If given intravenously 1 part is diluted with 2 or 3 parts of 5 or 10 per cent dextrose in water Restoring the level of serum potassium to normal may induce tetany if serum calcium remains low

K lactate is an appropriate solution for treating acidosis It is not used in Addison s disease and only in selected cases of renal acidosis In alkalosis with potassium depletion and a relative deficit of chloride in relation to sodium, a solution containing 6 Gm NaCl and 2.7 Gm. KCl/L. is diluted with 2 or 3 parts of 5 or 10 per cent dextrose in water if injected intravenously Dilution with dextrose may be omitted if injected subcutaneously

Compatible whole blood in amounts of 30 ml /kg body weight for an infant to half that amount for an adult is the most effective agent for prevention or treatment of

shock. In dehydration due to loss of electrolytes, effectiveness of the appropriate electrolyte solution is enhanced if blood or plasma is also administered. For each 100 calories metabolized, water requirement is 90-125 ml. This may be furnished by 10-20 ml. isotonic NaCl solution or K lactate and the rest as 5 or 10 per cent dextrose in water. When indicated, 2 Gm. amino acids may be added. An infant weighing 5 kg. and metabolizing 500 calories would require 450-625 ml. of such a mixture, whereas an adult would need 1,600-2,250 ml. When required, various vitamins may also be added to parenteral feedings.

Potassium Deficiency in Surgical Patients. Henry T. Randall, David V. Habif, John S. Lockwood and S. C. Werner[2] (Columbia Univ.) first obtained normal values from miscellaneous preoperative patients in the metabolic service who had no demonstrable disease other than hernia, inactive chronic cholecystitis or nontoxic nodular goiter. As a result, any plasma potassium value between 3.8 and 4.6 m.Eq./L. is considered normal, and occasionally the value may be higher, mostly in chronic or acute renal failure. Potassium balance and serum potassium level were then studied in three groups of patients in the metabolic unit. Group 1 consisted of patients fed a calculated standardized diet for 14 days until operation and then maintained for the operative and 4 postoperative days on dextrose in saline solution, dextrose in water and 10 per cent amino acids, all parenterally. They illustrate the amount of potassium lost in relatively minor procedures. Group 2 was placed on the same parenteral fluids including amino acids, but these were given for three preoperative days as well as postoperatively; in this group were one patient with umbilical and three with ventral herniorrhaphies and one with cholecystectomy. Group 3 was similar to group 2 except for addition of 50 m.Eq. potassium/day parenterally; the four patients had cholecystectomy, one with common duct drainage by T tube.

Groups 1 and 2 showed a consistent loss of potassium in excess of that associated with nitrogen. The largest losses occurred on the first day on parenteral fluids. Operation increased potassium loss in group 2 on the operative

(2) Surgery 2: 341-363, September 1949.

and first postoperative days, but the magnitude of the losses was below that occurring on the first day of parenteral fluid therapy Group 3 showed losses on the first day of parenteral fluids and on the operative and first postoperative days but maintained a positive potassium balance for the period. Plasma potassium levels fell below normal in group 2 but not in group 3 except for the operative day

The authors also determined the postoperative plasma potassium levels in 64 patients from the general surgical wards, most having major operations none had received any potassium parenterally or potassium-containing food or fluids orally since operation. There were wide variations but a marked fall below normal was usual It is suggested that pronounced deviations in plasma potassium level may serve as an approximation of degree of potassium deficit

The data obtained in 14 cases of hypochloremic alkalosis showed that this condition responds to oral intake of food and *to parenteral administration of potassium chloride*, although it is refractory to and made worse by sodium chloride It was concluded that hypochloremic alkalosis is in large part a primary potassium deficiency state Therapy consists of giving 60-120 m.Eq potassium daily with due regard to the total fluid volume permissible in the patient being treated

In the past year the authors have used potassium solutions prophylactically starting on the second postoperative day in patients whom they expect to carry on parenteral fluids for four or more days with not more than clear fluids by mouth, and by this means they appear to have reduced the number of patients in whom edema and alkalosis have developed The amount given is usually 30 m.Eq potassium daily *Rigid limitation of sodium infusions is an important* part of preventing potassium depletion and edema They have found useful for oral therapy a mixture of potassium acetate bicarbonate and citrate 1 Gm. each, made up to a volume of 8 cc with water This mixture contains 27 m.Eq potassium and can be given in 4 cc doses three times daily well diluted in fruit juice to supplement the potassium intake of patients who are tolerating fluid feedings. This sometimes eliminates the need for infusions.

Potassium Deficiency in Surgical Patients Its Recognition and Management are discussed by Everett Idris Evans[3] (Med. College of Virginia) Vomitus and drainage fluids from the stomach biliary tract and upper intestine contain large amounts of potassium. Unlike in the case of sodium, there is no renal mechanism which conserves body potassium, so even with severe potassium depletion there is continued loss in the urine If a patient loses large amounts of gastric and small bowel fluids by vomiting suction, diarrhea or alimentary tract fistulas and potassium is not replaced in adequate amounts, potassium deficiency to some degree must result

Signs and symptoms of extreme potassium deficiency are extreme muscular weakness paralysis of the accessory respiratory muscles, atony, coma low amplitude of T waves and lengthening of the Q T interval on the electrocardiogram and serum potassium of 2 6 m.Eq or below If an alkalosis (carbon dioxide content of 60 volumes/100 ml.) persists in patients with dehydration and salt loss due to excessive vomiting diarrhea or other causes after adequate hydration and sodium chloride therapy, potassium deficiency should be strongly suspected A serum potassium level below 3.5 m.Eq /L. confirms this suspicion but there can be potassium deficiency with normal plasma potassium levels. Continuous gastric drainage without adequate potassium replacement may result in potassium deficiency after four or five days The chief danger in treatment is in infusing potassium salts so rapidly that dangerously high levels of blood potassium are reached and poisoning results. The following method of treatment is suggested

TREATMENT—The patient s condition may demand relatively rapid infusion of large amounts of potassium chloride in a short period. If the renal function is unknown, potassium infusion should be preceded by intravenous infusion of 600-800 cc. of 5 per cent glucose in water to stimulate urine flow If the potassium level is below 3.0 m.Eq., relatively rapid rates of administration are less hazardous. Serial electrocardiograms may be used as a guide for therapy The emergency phase of potassium depletion may be treated with a few grams of potassium chloride administered over one to four hours. There is no fixed rule for the composition of potassium chloride solution. Further therapy consists of giving 2-4 Gm. KCl intravenously above daily losses. Oral administration should be started as

(3) Ann. Surg 131 945-959 June 1950

soon as possible by giving 5-15 gr KCl in tablets. The same amount in 1 oz. water may be administered through an indwelling gastric or jejunostomy tube. The dose should be given every 3-4 hours over 24 hours. Gastric and intestinal drainage is restricted to the shortest possible time sodium and potassium chloride replaced adequately and use of intravenous fluid therapy restricted to the individual patient's need for prevention of postoperative potassium deficiency. Early withdrawal of tubes from all orifices and giving well cooked, appetizing food, even in small amounts, greatly diminishes the number of patients with this deficiency

Refractory Alkalosis and Potassium Ion in Surgical Patients Russell M Nelson, Stanley R. Friesen and Arnold J Kremen[4] (Univ of Minnesota) state that hypopotassemia has been produced in animals by diets low in potassium after injections of desoxycorticosterone acetate and in man after prolonged testosterone medication and prolonged therapy with solutions containing only glucose and sodium chloride It has also become clinically important in association with hereditary or familial periodic paralysis, hypercorticoadrenalism, severe acute and chronic nephritis and the recovery phase of diabetic acidosis Refractory alkalosis is closely allied with hypopotassemia. When intracellular potassium is depleted and intracellular sodium increased, biologic equilibrium is achieved only by a high serum bicarbonate which in turn increases output of urine chloride The authors report a case which presents many interesting aspects

Woman, 30 had a congenital duodenal diaphragm with alkalosis and hypochloremia which resisted treatment with usual measures until a potassium deficiency was corrected. She had one of the lowest serum potassium levels recorded in a human being 0.98 m.Eq /L. Factors which had contributed to this were (1) no potassium intake for over 50 days except for small amounts in amigen* and blood, whereas the kidneys still excreted about 1 Gm. daily, as determined at the peak of the potassium deficit (2) administration of 125 mg testosterone (effect difficult to ascertain) (3) daily infusion of glucose and saline and (4) vomiting and gastric juice aspiration.

Urine contained 0-8 Gm. chloride/L., bicarbonate was increased and potassium decreased. However once the potassium level was normal in the serum and presumably in muscle the bicarbonate level fell and a more normal excretion of chloride was again found

The finding of a complete diaphragm in the duodenum was unusual, especially in view of the patient's age. Obviously some con

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(4) Surgery 6 40 January 1950

nection had existed between the stomach and the small intestine since obstruction did not become complete until three or four weeks before hospitalization. It would seem that a previous aperture in the diaphragm had closed over, perhaps as a result of pancreatitis.

The electrocardiogram (ECG) was used in guiding replacement therapy When the potassium level was 0.98 m.Eq./L., it showed a second degree heart block with Wenckebach's periods and occasional supraventricular premature systoles, depression of the S-T segment and low or negative T waves in all leads. Six hours later, after 1 Gm. KCl had been given intravenously, heart block and extrasystoles were still present, but there was less S-T depression in leads CF_2, CF_4 and CF_6. The next day, after administration of 3 Gm. KCl, heart block was reduced to a consistent first degree block and there were no extrasystoles. Two days before surgery the normal electrolyte pattern was restored and an ECG was also normal.

Three additional cases are reported to substantiate the importance of refractory alkalosis and hypopotassemia. The institution of potassium replacement requires a good urine output and cautious administration Toxic levels may cause cardiac arrest.

Potassium Metabolism and Potassium Treatment in Surgical Patients *On the basis of observations on four patients* on whom various types of colon surgery were done N. Blixenkrone-Møller[5] (Aarhus Denmark) states that when considerable fluid and potassium losses result from vomiting or diarrhea, serum potassium levels are lowered and potassium concentration and potassium excretion in the urine are slight. If primary damage to the cells has occurred, e.g., owing to dehydration, serum potassium levels are increased and potassium concentration in the urine is higher Regardless of whether potassium loss is due to intra or extracellular dehydration, treatment should consist of intravenous administration of fluids containing potassium ions In one patient potassium loss was accompanied by electrocardiographic changes showing low T waves. After potassium treatment the electrocardiogram became normal.

Patients with surgical renal diseases may have a moderately elevated serum potassium level but comparatively low potassium concentration in the urine If urinary output is increased potassium excretion is increased and hence a negative potassium balance may result If moderate amounts of potassium are given intravenously to these patients,

(5) Acta [illegible] Scandina 99 237 251 1949

there is only a slight increase of serum potassium, because most of it is rapidly deposited in the tissues as in normal subjects. Potassium ion need not be withheld from those with renal disorders unless there is anuria or very low urinary output. In this event potassium may be given if serum potassium levels are closely watched.

Potassium Deficiency in the Postoperative Patient. Cornelius E. Sedgwick[6] states that inadequate intake of potassium, abnormally large losses of potassium from the gastrointestinal tract, and continued loss of potassium in the urine even in the presence of a deficit are responsible for postoperative potassium depletion. Most of the symptoms of potassium deficit appear late. The patient seems chronically ill and complains of extreme weakness. Respirations are shallow and there are both motor and sensory disturbances such as paresthesia and flaccid paralysis. Prolongation of the Q-T interval, low or inverted T wave, an S-T segment sag or a depressed take-off from the S-T segment are typical electrocardiographic changes indicative of serum potassium deficit. After the diagnosis is established therapy should be instituted at once.

Oral administration of potassium is more effective and safer than intravenous injection. Potassium chloride should be given in doses of 2 Gm. every two to four hours. It can be given in fruit juice or beef broth, both of which have a large content of potassium which supplements the added potassium chloride. Intravenous solutions should contain 2.5-3 Gm. KCl/1,000 cc. water with additional salts to act as buffers. Since intravenous injection of potassium is potentially dangerous, solutions should not be given at rates greater than 12 cc. (180 drops) a minute.

As a result of therapy, electrocardiographic changes are the first to revert to normal, and paresthesias and loss of peripheral reflexes are the last to change.

(6) S. Clin. North America 30:799-806, June, 1950.

Parenteral Nutrition in Surgical Patient as Provided from Glucose, Amino Acids and Alcohol Role Played by Alcohol. According to Carl O Rice, Burton Orr and Irving Enquist[7] (Minneapolis) postoperative patients have a more satisfactory convalescence if full nutrition is provided immediately after surgery The routine hospital diet does not provide adequate calories or protein. To provide adequate nutrition, a mixture of glucose, amino acid and alcohol was given routinely to more than 600 surgical patients postoperatively

METHOD —Immediately after operation, 1 000 cc. fluid, containing 5 per cent amino acids, 5 per cent glucose and 60 cc. of 98 per cent alcohol, is given slowly over four hours, during which the patient usually sleeps or dozes. Morphine is rarely given or required. In the late afternoon and evening another 1 000 cc. is given. On the following morning the patient is offered food and, if enough is consumed no further parenteral nutrition is given. If the patient does not eat well parenteral nutrition is used as a supplement to meet the calculated metabolic requirements. Vitamins B and C and electrolytes are added as needed.

In the first 12 hours after operation, this treatment provides 100 Gm. amino acids, 100 Gm. glucose and 120 cc alcohol, a total of 1,472 calories.

When alcohol calories are substituted for glucose calories, there is an increased nitrogen output and a decreased nitrogen balance This suggests that alcohol calories alone cannot completely replace glucose calories, for apparently the latter are necessary for the economic utilization of amino acids When part of the calories is provided by glucose and part by alcohol, a slightly higher nitrogen balance is obtained. Metabolic studies have shown that it is difficult to maintain a strong positive nitrogen balance without providing full caloric requirements, unless an overabundance of nitrogen is provided. However, it is more practical to maintain a positive nitrogen balance by providing readily available calories in the form of alcohol. Nitrogen is spared and energy provided which otherwise must be obtained from body reserves

(7) Am Surg 131 289-304 March, 1950

Tissue Protein Studies in Normal and Undernourished Males Changes in Total Circulating Protein after an Intravenous Saline Infusion as Index of Protein Stores were studied by John E Harroun, Charley J Smyth and Stanley Levey[8] (Wayne Univ) In six normal persons plasma volume, total serum protein and albumin and globulin fractions were determined before and 30 minutes after infusion of 1 L. physiologic saline solution. Similar studies were made in nine undernourished persons four of whom were encouraged to consume a high caloric and protein diet.

In the normal persons, plasma volume increased an average of 440 7 ml. after infusion Total circulating proteins were increased in each an average of 13 9 Gm In the undernourished persons, plasma volume increased an average of 169 9 ml. and total circulating protein showed a decrease averaging 14.7 Gm. Albumin made up more of the increase in total circulating protein than globulin in four of the normal persons whereas in one the reverse was true In five of the six undernourished persons, albumin contributed more to the decrease in total circulating protein than globulin. Diets which furnished the undernourished persons 3 000-4,500 calories/day and 2-4.5 Gm. protein/kg body weight/day eventually resulted in increase in plasma volume and total circulating protein.

Liver cells may be chiefly responsible for the different patterns demonstrated by the normal and abnormal persons. Protein interchanges depend on the passage of intact proteins through cellular membranes.

The data suggest that intravenous saline infusion of at least 1,000 ml is sufficient stimulus to either increase or decrease total circulating protein and so differentiate a *normal state of protein nutrition from a state of protein* depletion.

Chronic Hypoproteinemia. Guiseppe Costa[9] (Univ of Turin) states that the evaluation of latent alterations in protein metabolism and correction of deficiencies are most important before surgical operations because it has been amply demonstrated that anesthesia, shock, fever vomiting and

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(8) J Clin. Investigation 29 212 217 February 1950
(9) Schweiz. med. Wchnschr 79 1269-1272 Dec 31 1949

fasting after surgery upset the equilibrium of the body Reserve become depleted and must be restored

Proteins are contained in various tissues and vary in physiologic importance The largest amount in intracellular fluids is in the muscles and acts largely as a reserve supply The storage of proteins in the liver is small but it is available in emergencies such as hemorrhage The plasma proteins—serum albumin, globulin and fibrinogen—are produced by the liver reticuloendothelial system, bone marrow and by disintegration of blood corpuscles. They are stable chemically and physically They maintain osmotic pressure in the blood, exert functional resistance in arterioles, contribute to the acid base equilibrium and supply the organism with proteins. The integrity of the circulation depends on them Fibrinogen is essential for coagulation of blood and globulin for formation of antibodies in active and passive immunity Suppression of alimentary proteins is followed by simultaneous withdrawal from all body tissues.

A reduction in plasma proteins does not always indicate a total lack of proteins in the organism A latent deficiency can be assumed only on the basis of loss of weight, long illness and such diseases as peptic ulcer cancer of the biliary tract ampulla of Vater or head of the pancreas, gastrojejunocolic fistulas, ulcerative colitis or regional enteritis, hyperthyroidism, purulent discharges, or chronic infections. In short patients who are frail and subject to all manner of postoperative complications may have a latent protein deficiency

Influence of Caloric Intake on Fate of Parenteral Administered Nitrogen. Edwin H Ellison, Robert S McCleery, Robert M Zollinger and Clarke T Case[1] (Ohio State Univ) find that the emphasis on meeting protein requirements has resulted in a tendency to overlook the importance of supplying calories sufficient to meet basal energy needs. There has been much confusion about what constitutes optimal caloric intake Figures varying from 6 to 45 calories/kg /day are found in the literature But the disagreement is more apparent than real and depends primarily on whether the desired end is protein maintenance or restoration. Dextrose solutions of 15 and even 20 per cent have been advo-

(1) Surgery 26 374 383 September 1949

cated to supply the energy requirement The authors attempted to determine the optimal caloric intake and, by implication, the concentration of glucose which insures the most efficient utilization of parenterally administered protein supplied as amigen.* This was done by carefully controlled nitrogen balance studies on patients in a separate unit for metabolic studies staffed by a special personnel. All patients were protein impoverished and emaciated with lesions in or closely associated with the gastrointestinal tract amenable to surgical correction. History of inadequate food intake, 15-20 per cent loss of body weight and subnormal serum protein values were common to all.

Stabilization with regard to nitrogen exchange is best effected when nitrogen intake approaches zero Accordingly the minimal endogenous level of nitrogen excretion was established through a seven day depletion period. Then a comparison of nitrogen equilibrium was made during three three-day periods of supplementation, as daily caloric intake was raised from 1,155 to 1,755 and 2,385 calories The supplements consisted of 5 10 and 15 per cent dextrose in 5 per cent amigen.* The supplementation periods were alternated with two day depletion periods to avoid overlapping effects in this manner each patient served as his own control. Total fluid intake was maintained at a constant level and adequate vitamin B complex and vitamin C were given daily

The authors concluded that utilization of protein given intravenously is related to total calories given simultaneously Even if nitrogen intake remains constant, nitrogen retention is increased when total calories are increased. The higher concentrations of glucose are preferable to the commonly used 5 per cent glucose in 5 per cent protolysate The choice between 10 and 15 per cent concentrations of glucose and the total daily amounts of 5 per cent protolysate to be administered to a given patient depends on the clinician's goal. For example an adult of 70 kg will require 2 L. of 15 per cent dextrose or 3 L. of 10 per cent dextrose in 5 per cent protolysate daily for basal maintenance and 3 L. of 15 per cent dextrose in 5 per cent protolysate daily to assure restitution of protein and weight gain

time preceding operation and that of control after operation cannot be explained by the amount of fat eliminated in the stool.

[It is hard to understand what influence vagotomy could have in this respect.—Ed.]

Intravenous Infusions of Concentrated Combined Fat Emulsions into Human Subjects B G P Shafiroff, J H Mulholland and E Roth[4] (New York Univ) prepared two types of combined fat emulsions one containing 15 per cent fat and the other 20 per cent fat The emulsions were given in varying amounts to 25 persons in 51 injections After a 14 hour fast infusion was given intravenously at a rate of 20-80 drops/minute the amount infused was 500 mL of either emulsion In several persons a second infusion was given in the late afternoon In many respects the effects were similar to those noted in studies with 10 per cent emulsion Constitutional reactions such as high temperatures and chills averaged 27 per cent compared with 9 per cent with the more dilute emulsion About 50 per cent of the reactions were due to the speed with which the emulsion was administered, the fast infusions being associated with the chill reaction. The temperature rises could be accounted for on the basis of a sudden plethora of fat During the infusion there was generally a slight elevation of blood pressure followed by a moderate fall which persisted for two hours after infusion. There were no tendencies toward development of shock. Tests for blood, urobilinogen diacetic acid or fat in the urine were negative Follow up studies showed no signs of hemolytic anemia Lung x rays gave no evidence of fatty emboli or pulmonary irritation Liver and lung biopsy specimens and liver and kidney function studies showed no pathologic alterations attributable to the emulsions

Parenteral Nutrition Observations on Use of Fat Emulsion for Intravenous Nutrition in Man were made in 11 patients by Sherwood W Gorens, Robert P Geyer LeRoy W Matthews and Frederick J Stare[5] (Harvard Univ) The wide variety of common ailments represented had resulted in weight loss of such extent that n for adequate calories was essential for good tre e fat emulsion

(4) Proc. Soc. Ex 73 642-64 49
(5) J Lab. & Cl 1933 Dec

used consisted of 15 per cent coconut oil, 4.3 per cent dextrose and a combination of 0.5 per cent soy bean phosphatides and 1 per cent polyglycerol esters as stabilizers. Most fat particles were of less than 1 μ diameter and none were larger than 3 μ. The emulsion furnished 1,600 calories/L. and could be infused at rates commonly used for intravenous administration of glucose or saline solutions. Daily amounts up to 3 Gm. fat/kg. body weight were given adults and 6 Gm./kg. body weight in an infant aged 7 weeks. Infusions were given for 3-27 consecutive days.

Observations indicate that fat emulsions are useful as a source of calories in parenteral nutrition. The effects on nitrogen and potassium balances were favorable emphasizing the necessity of adequate calories for protein synthesis in the body. Temperature rises were noted in three patients but were thought due to pyrogenic materials in the fat rather than to the fat itself.

Death occurred in three patients. In one the fat given intravenously furnished two thirds of the total caloric intake for seven days. Gross and microscopic postmortem examinations in this and another patient revealed no undesirable condition attributable to the fat emulsion.

WOUND HEALING

Pertinent Factors Influencing Repair in Traumatic Wounds are evaluated by Kenneth F. Lowry and George M. Curtis[6] (Ohio State Univ.) on the basis of over 1,700 such wounds seen during World War II. One of the most important factors in eliminating infection is a thorough débridement.

Technic.—The skin is incised in the long axis of the limb until the entire wound is visualized. Unnecessary sacrifice of tissue, especially skin, is avoided. All foreign material and traumatized and devitalized tissue including muscle and unattached bone fragments are meticulously removed or excised. The entire wound must be treated under direct vision if major nerves and blood vessels are to be preserved and hemostasis obtained. After débridement the wound may be lightly dusted with sulfanilamide crystals and then covered

(6) Am. J. Surg. 78:781-792, November, 1949.

with lightly impregnated petrolatum gauze, introduced into the depths of the wound. The petrolatum gauze is covered with fluffed sterile gauze and a pressure dressing applied The wound should be well immobilized by the pressure dressing plastic splint or encasement. If encasement is used, the importance of bivalving the cast cannot be overemphasized.

Secondary wound infection is an important factor delaying healing Secondary invaders may come from the respiratory tract of the patient or unmasked nurse, surgeon or ward attendant, the skin of anyone touching the wound, unsterile instruments or exposure of the dressing to dust laden air The impulse to change a soiled dressing for a clean one or to peep at the wound should be overpowered by the realization that "inspection means infection"

Except for wounds of the hands, face or scalp primary suture should never be utilized in war wounds. Even when aseptic excision *en bloc* procedures were accomplished 50 per cent of the wounds primarily closed became infected The most important influence on the success of delayed suture is the time interval between initial surgery and closure. Optimal time interval for closure is four to five days. After this wound edges become fixed with inversion of the epidermis, and the added trauma required to accomplish suture results in a pronounced drop in percentage of healing Many traumatic wounds which occur in civilian life may be safely closed immediately after débridement. If a civilian wound is associated with striking tissue destruction or severe contamination if there has been a delay between injury and treatment or if there is a risk of infection it may be more safely handled by leaving it open until localized immunity has fully developed

Routine bacterial cultures of wound flora are of no practical value except when there is established gross infection. Application of any wet dressing to an open wound introduces the hazard of secondary invaders, prolongs the important time interval between initial surgery and delayed suture and results in a reduced percentage of healing Wet dressings should be reserved for wounds with gross infection. Recent investigations suggest that in severe localized infections infiltration around the site with up to 20 cc. bacitracin solution (500 units/cc) combined with 1 per cent procaine, may be beneficial Infiltration may be supplemented with top-

ical applications of this solution However use of bacitracin does not replace any of the fundamentals of good surgery

Every effort must be made to minimize and decrease local edema following delayed suture or skin graft. A pressure dressing with mechanics' waste and an elastic bandage is ideal. Elevation of the limb postoperatively for 24-48 hours and immobilization aid wound healing Immobilization should be absolute and favor function and approximation without tension In most uncomplicated soft part wounds, plaster cast or molded splint is unnecessary pressure dressings combined *with the patient's co-operation regarding bed rest provide* adequate immobilization After 24-48 hours limited movement may be instituted. This favors lymphatic drainage which further reduces wound edema and discourages adhesion of sutured skin to underlying tissue, lessening the subsequent need for extensive physical therapy

Hemoglobin, hematocrit and plasma protein determinations should be made frequently for blood replacement is as important as chemotherapy in controlling infection and promoting healing Furthermore the retarding influence of hypoproteinemia on wound repair is well established. Many post operative infections may be partly due to lowering of the immunologic response of the body secondary to protein starvation. Actually all of the more severely wounded needed blood in amounts of 500-2,000 cc Although intravenous plasma was used to restore protein levels it has been found that up to 150 Gm. protein/day may be given intravenously in the form of hydrolysates or amino acids. Glucose may be added to this for its protein-sparing effect. Oral or tube feedings of a skimmed milk powder formula is an economical and satisfactory method for treating protein deficiency

[Probably the authors would not now advocate the dusting of wounds with sulfanilamide crystals. However débridement, in the sense of wound excision is most important. This fact was firmly established in World War I. —Ed.]

Effect of ACTH on Wound Healing in Humans was studied by Morton C Creditor Margaret Bevans, William L Mundy and Charles Ragan[7] (Columbia Univ) Elliptical skin biopsies were taken on the first day of ACTH therapy from a patient with periarteritis nodosa and one with rheumatoid arthritis The wounds were closed with silk and after one

(7) Proc. Soc. Exper Biol. & Med. 4 245-247 May 1950

week the area was excised. Normally such wounds should either be in the advanced stages of healing or completely healed the rebiopsied wounds showed no microscopic evidence of healing of mesenchymal tissues There was proliferation of epithelial structures but practically no granulation tissue Rebiopsy and histologic examination a week after cessation of ACTH showed normal healing

An incision made in the thigh of a patient with rheumatoid arthritis on ACTH therapy was irrigated through a catheter six times daily with 0 5 cc. of a solution containing 90 turbidity reducing units of bull testes hyaluronidase and 50 000 units of penicillin. A control incision on the opposite leg was irrigated with penicillin solution alone Both wounds were excised after four days The control wound resembled those previously described The hyaluronidase-treated wound appeared healed grossly Microscopically it was bridged by a continuous layer of epithelium, but the subepithelial layers were filled only with fibrin and there was no evidence of fibroblastic activity The significance of this "false healing" is unknown These observations indicate that during hyperadrenalism induced by ACTH there is inhibition of wound healing in human beings

Wound Healing and Heparin, Using Heparin Deposits. The depot heparin used by R M Bendix and H Necheles[8] (Michael Reese Hosp) was prepared by precipitating heparin quantitatively with aqueous benzidine hydrochloride. The precipitate was resuspended in isotonic saline solution so that 1 cc. contained 10 mg (1,000 units) heparin To test the effects of heparin on wound healing dogs and albino rats were subjected to gastrostomy and depot heparin was administered subcutaneously in the morning and evening postoperatively Subsequently the strength of gastrostomy wounds and abdominal incisions was ascertained by recording the air pressure required to disrupt them.

The breaking point of gastrostomy wounds in control rats was most uniform five days after operation Average value of the breaking points at this time was the same in heparinized as in nonheparinized animals In dog experiments, the sixth day after gastrostomy was chosen as end point Control clotting time was 3 minutes, whereas clotting times in hepa

(8) Surgery 26 99-605 November 1949

rinized animals varied between 7½ and 35 minutes The strength of the gastric and abdominal wounds in control dogs and in heparinized animals was within the same range The effect of dicumarol[8] was to be studied in several dogs, but all died or had to be killed before the end of the six days be cause of complications such as pneumonia, fatty infiltration of the liver and hematomas The tensile strength of stomach wounds in these animals two to four days postoperatively was considered sufficient to withstand the usual intragastric pressure

Use of one or two subcutaneous injections every 24 hours of the heparin benzidine complex, proposed by Jaques seemed to be sufficient to prolong clotting time of blood in the rat and the dog above 50 per cent This complex is not proposed for use in man because benzidine (bi aniline) is suspected to be cancerogenic

[These experiments seem to answer in the negative the often expressed query as to whether or not the use of heparin postoperatively will delay wound healing.—Ed.]

Local and Systemic Effects of Chronic Ulcerations Louis T Byars and Gordon S Letterman[9] (Washington Univ) state that ulcers commonly result from burns, circulatory le sions, chronic bacterial infections, neurogenic disturbances, malignancies and various forms of trauma With full thick ness loss of skin the wounds may heal very slowly not at all, or completely only to break down repeatedly after insignifi cant trauma or limited activity Infection general debilita tion, hypoproteinemia, anemia and chronic shock often occur as complications. Vigorous treatment aimed at prevention and correction of these complications may retard but not stop the patient's downward course The only satisfactory final solu tion is to establish a well healed wound as soon as possible

There is no topical agent which alone can minimize infec tion eliminate scarring and speed healing Large areas of skin loss by avulsion should be replaced immediately Emer gency grafting of a fresh wound prevents the deleterious lo cal and systemic effects of chronic ulceration minimizes de formity and promotes earlier restoration of function Al though such immediate treatment may be impossible or not available for other types of tissue loss the principle of rapid healing by means of skin grafts is just as applicable

(9) Surg., Gynec & Obst 9 5 3 590 November 1949

In burned patients the heroic procedures necessary to save life at the time of the acute burn must be continued until a clean wound is obtained and a skin graft successfully applied Large sheets of split thickness skin must be placed on the ulcerated area two to five weeks after injury Thus, health is restored in a matter of weeks rather than years. Use of pinch grafts to cover large areas does not solve the problem but simply alters the equation of the patient s tenacity of life vs. slow wound healing In many patients death appears inevitable because of the size of the ulcer Use of homografts, sheets of split thickness skin taken from other persons, may be lifesaving Although such skin does not persist, it converts a huge open wound with its many destructive systemic effects into an advantageous temporarily healed area

Many patients have small chronic leg ulcers which are resistant to the usual treatment. The most direct, quickest and best therapeutic approach is adequate excision of the ulcer with its surrounding thin scar epithelium and underlying avascular scar The defect should then be covered immediately with a skin graft of intermediate thickness. When the local lesion is eliminated healing may be maintained by limited use of the leg and wearing of elastic bandages or support. Long-standing ulcerations resulting from osteomyelitis or compound fracture may be permanently eliminated by similar treatment.

Marjolin s Ulcer Preventable Threat to Function and Life Donald M Glover and Clifford L. Kiehn[1] (Western Reserve Univ) present seven cases five of which occurred in burn scars of 20-50 years' duration All lesions were squamous cell carcinoma The only deaths were in two patients with lymph node involvement.

Suspicious looking ulcers in scars of long duration should be studied with thorough and frequent biopsies. Cellular changes such as atypical epidermal proliferation pearl formation or mitotic figures, even without clearcut evidence of invasion, are sufficient to warrant radical surgical treatment. It is likely that if such a tissue block is sectioned methodically frank carcinoma will be found.

Most observers have found that this type of carcinoma remains localized for a long time If treated by radical surgical

(1) Am J Surg 78 772 780 November 1949

resection and skin replacement there is an excellent opportunity for cure or long survival if regional or remote metastases have not appeared When local bone invasion has occurred, amputation is the only practical treatment. Radical regional lymph node dissections are unnecessary if there is no objective evidence of lymph node metastasis

It is apparently possible to prevent these ulcers by proper skin replacement many years after injury for there is no reported case of Marjolin's ulcer in a lesion which was adequately skin grafted. Granulating wounds or contracted scars should be treated with free grafts, pedicle grafts or Z-plasties. Free grafts and Z-plasties will relieve most scars, but in some regions in which elasticity is necessary pedicle flaps must be used. Thick split grafts are probably more satisfactory than large full thickness free grafts. When the former are carefully sutured into defects under somewhat less than normal skin tension the resulting skin is of almost normal thickness and mobility after one or more years. Use of sponge rubber makes application and fixation of these grafts relatively simple

An additional case is reported to show that x ray treatment of contracted scars which tend to break down is futile and dangerous.

Effectiveness of Chloresium in Wound Healing and Deodorant Effects To evaluate their results, N Henry Moss, Burton A. Morrow Richard C Long and I S Ravdin[2] (Univ of Pennsylvania) used Du Noüy's formula, which permits prediction of the period in which a wound should normally heal and calculation of the expected area of the wound at any time during the course of repair and the method of Smelo to determine the precise measurements of the surface area of the wound at every dressing Cultures were taken at frequent intervals to follow the effect of chloresium preparations on the bacteriologic make-up of the wounds.

The investigation on healing was carried out on 25 patients 11 had infected wounds, 3 surgically clean wounds, 3 burns, 6 lesions resulting from venous stasis and 2 ulcers due to sickle cell anemia Chloresium ointment in moderately generous quantities was applied to a square of gauze dressing which was placed over the wound and fixed with simple band

(2) J A. M. A. 140 1336 1339 Aug. 27 1949

aging Dressings were changed every other day When necessary, local débridement of devitalized tissue was performed. One patient had an allergic skin reaction and therapy was discontinued before adequate data were available.

The treatment was associated with acceleration of healing in 5 of 24 patients and in 3 of the 5 there were local or general factors known to impede the healing process The wounds of four patients healed in the normal expected time and in two of them healing was influenced by local factors. The remaining 15 patients had a rate of healing less than the theoretical by the Du Noüy formula in 13 there were local or general factors impeding healing These results suggest that chlorophyll therapy is not a constant promoter of wound healing within the time limits expected under Du Noüy's formula There was no evidence that chlorophyll therapy retarded wound healing

Untoward reactions to chloresium consisted primarily of slight itching, noted by six patients. One of two other patients in whom vesicular eruptions occurred was known to have a definite allergic background Treatment should be discontinued if redness or itching appears

In 3 of 10 instances the chloresium ointment may have had bacteriostatic activity The organisms influenced included hemolytic Staphylococcus aureus, alpha and beta streptococci and an unidentified gram negative rod

In 11 patients studied chlorophyll therapy consistently decreased the odor of foul smelling wounds on the average within 24-48 hours.

Regardless of the effect on healing rate the wounds treated with chloresium ointment had an exceptionally healthy appearance

Explorations into Physiologic Basis for Therapeutic Use of Restrictive Bandages in Thermal Trauma Experimental Study Frederic W Rhinelander John L. Langohr and Oliver Cope[3] (Massachusetts Gen'l Hosp) burned the hind feet of dogs by plunging them into water at 100 or 90 C for 15 seconds Immediately after burning a thin, skintight plaster bandage was applied to one foot, and the other was not dressed. Cannulation of the lymphatic vessels just above the ankles showed an initial increase in rate of inflow after burn

(3) Arch Surg 59 1056 1059 November 1949

ing which was more rapid in the foot with the cast but which rose to a higher level in the foot without a cast There was no constant difference in the rate of subsequent reduction of flow Intravenous infusion of isotonic sodium chloride solution almost immediately produced similar increases in the amount and rate of lymph flow in treated and untreated legs. Apparently casts reduced the increased flow of lymph toward normal but insufficiently to permit lymphatic vessels to carry the load, and edema piled up in the interstitial spaces of the leg proximal to the bandage While loss of plasma volume is retarded it is not eliminated and presumably not reduced

Lymph protein concentration was consistently slightly higher in the foot with a cast than in the foot without one Chloride concentration was lower in the lymph with the higher protein concentration. Such findings indicate a greater resorption of water into the venous blood Venous pressures, arteriovenous oxygen differences and arterial blood flow were not altered by the plaster bandage.

The pressure between the surface of a burned foot and the inside of the cast rose rapidly after the burn, reaching its maximum in 1 1½ hours. Thereafter it ranged between one half and two thirds of the mean arterial pressure Arterial blood therefore does not flow against a rigid wall, the outflow of venous blood and lymph providing some elasticity Variations in rate of exudate formation on burned surfaces followed changes in blood pressure The protein concentration of the exudate fluid was lower than that of lymph collected from the lymphatic trunk on the same leg Possibly the benefit which clinically follows use of restrictive dressings comes from immobilization of the wound Such dressings must not be used with the idea that the need for plasma therapy in burn shock will be reduced materially Whether the benefit of their use outweighs the danger of gangrene from improper application depends on the intelligence with which they are used

Impairment of Sensation in Burns and Its Clinical Application as Test of Depth of Skin Loss Early diagnosis of the depth of burn damage is important if areas of full thickness loss are to be immediately grafted. Sometimes the appearance of the burn indicates its depth, but in many cases there is doubt and accessory tests would be valuable J P Bull and

J E Lennard-Jones[4] (Birmingham, England Accident Hosp) observed a series of experimentally produced burns ranging in severity from slight erythema of the skin to full thickness lesions Stimulation with heat and cold disclosed that thermal sensitive spots in the skin are more sparsely distributed than touch and pain receptors, and apparent loss of thermal sensation may not be significant Touch sensibility was only seriously impaired in full thickness burns and in some cases there was persistent touch sensation making clear judgment of depth impracticable

Pain response to stimulation with a weighted needle could be correlated with the depth of burning Burns with slight skin damage revealed temporary hyperalgesia of the area. With increasing degrees of partial thickness damage, the proportion of painless responses increased. In full thickness burns pain sensibility was greatly reduced or completely absent.

In six patients with moderately severe burns the close relation between pain sensation and depth of burn was confirmed by this method

Has Digestion of Slough by Pancreatic Ferment Been Found Valuable in Treating Severe Burns? The multiplicity of local treatments of burns indicates that the ideal method has not been found Kurt Stucke[5] (Univ of Göttingen) reviews the present forms of therapy and reiterates the basic principle that the sooner the defect can be covered by skin grafting the better will be the final result. Surgical excision or cauterization are seldom possible for anatomic and biologic reasons. Scar forming agents save life but do not prevent exudation wound infection or poor functional results. An ideal agent should be harmless to tissues, prevent loss of plasma, stop pain, and eliminate shock and undue strain on the circulation. It must not require anesthesia, endanger asepsis or injure healthy epithelial islands Healing must be accomplished without scars or contractures.

Stucke believes that pancreatic ferment fulfills these requirements. In the past three years 63 severely burned patients were treated locally with trypsin mixtures. Primary skin grafting was necessary in only 8 per cent keloid and

(4) Clin. Sc. 8 155 169 September 1949
(5) Chirurg 20 588-595 November 1949

contractions occurred in only 5 per cent, and cosmetic as well as functional results were excellent. Necrotic tissue was removed in as little as 5 days and the length of treatment was reduced from the former average of 93 to 22 days.

A paste composed of trypsin, sodium bicarbonate, glycerin and penicillin was used without reducing the efficacy of the ferment. Toxic absorption did not occur.

Stucke does not feel that this limited experience justifies wholesale recommendation of the use of pancreatic ferment. More exhaustive studies are in order.

Problem of Skin Homografts Brief Review of the main hypotheses advanced to explain the cause of sloughing is presented by Blair O Rogers[6] (New York City). The least popular hypothesis is the hematologic one which supposes that homografting of skin would be permanently successful if the principles underlying transfusing of blood were applied. If donor and host are of the same or compatible blood group grafting between the two would succeed permanently and if not, it would fail. Most clinical and experimental evidence refutes this hypothesis, for grouping donor and host even to the Rh and MN factors does not seem to alter the survival time of the graft in any way.

The genetic cellular hypothesis is based on the idea that the response of the body of the host against the graft is a local tissue reaction founded on genetic or individual differences between them. Most reports note lack of success in cases in which there was no genetic or familial relationship but neglect to add that both clinically and experimentally success or increased survival time of the graft was not achieved when genetic similarity was present. Homograftings between monozygotic twins have been uniformly permanently successful, but it should be noted that this is not homografting in the true sense but autografting. Such twins share the same blood groups and the same organ and tissue specific substances, and, having come from the same ovum, there is no individuality differential distinction between them. Therefore reports of increased survival time in animals closely inbred for generations are essentially of academic interest only and serve no purpose so far as treating man is concerned. There is little substantiating evidence supporting this hypothesis.

(6) Plast & Reconstruct. Surg 5 269 8 April, 1950

The acquired immunity hypothesis has the largest amount of clinical and experimental evidence to substantiate or to refute it Proponents believe that the graft elaborates antigens, which, after the usual latent period are neutralized by the antibodies which they have called forth from the host. The resultant antigen-antibody reaction destroys the graft. The opposition properly states that no circulating or fixed antibodies have ever been shown to exist in homografts. Until an antigen-antibody response is demonstrated as taking place locally in the tissues, this is a substantial barrier to accepting the hypothesis. Experimental evidence in some respects supports the acquired immunity hypothesis, but clinical evidence is contradictory Finally most evidence supporting either side is circumstantial only

The development of a new hypothesis should be one of the first objectives in the homografting field No vascular tissue has ever been homografted with permanently successful results, but avascular tissues such as cornea and cartilage have been successfully homografted Grafts of epidermis, which is avascular *without any vascular attachments* should be tried. Another possibility is suggested by the fact that every other tissue in the body except skin has been shown to have group specific substances identifying it. If there are skin groups, no simpler method is possible than matching groups of donor and host by some quick test in vitro

Streptococcic Enzymatic Débridement is the use of streptococcic concentrates containing streptokinase and streptodornase in eradicating the loculations or exudations of chronic infections. William S Tillett Sol Sherry L R Christensen, Alan J Johnson and George Hazlehurst[7] (New York City) used this method in patients with diseases characterized by fibrinous or purulent exudations and including the following types of disorders loculated, postpneumonectomy hemothorax traumatic hemothorax sterile loculated empyema bacterial empyema other local infections (osteomyelitis, paranasal sinusitis etc.) and miscellaneous chronic ulcerative lesions. Both streptokinase and streptodornase were present in the partially purified preparations used for injection. Although the quantities of each varied in different preparations, individual dosage for intrathoracic use ranged from 100 000

(7) Ann [illegible] 131 12 22 January 1950

to 400 000 units of streptokinase and from 5 000 to 40 000 units of streptodornase The combined units of each were contained in 2 10 cc. physiologic salt solution When the areas of disease were smaller, unit content given was also smaller, but treatments were repeated over several days or weeks. Results demonstrated the usefulness and rapid effectiveness of this treatment.

In patients in whom extravascular clotted or loculated hemorrhage without infection was the principal difficulty rapid lysis of fibrinous strands and coagulum was accomplished primarily through the action of the streptokinase system. The possible necessity of surgical decortication appears to have been obviated by the effectiveness of the enzymatic decortication When infection was present, mechanical effects of loculation were complicated by a coating of tissue surfaces with the desoxyribose nucleoprotein of purulent exudates and fibrin. In addition, viable organisms present were a constant stimulus to formation of more exudation through which chronic infection was maintained

When treatment was effective the following changes were observed decided thinning of the exudate outpouring of viable leukocytes decrease in or disappearance of the locally infecting bacteria subsequent decrease or disappearance of exudate, and rapid regrowth of tissues and epithelium.

The results strongly suggest that the effective clearing of the site of infection through enzymatic action renders the area permeable to humoral and cellular forces of natural, specifically acquired immunity, or to circulating antibiotics capable of eliminating the organisms. The rapid rate of regeneration of the soft tissues and epithelium after débridement implies that an unusual effect is exerted on fixed tissues.

Reaction of Various Tissues to Implants of Collagen Derivative. Arthur F Battista[8] (Univ of Western Ontario) states that the physical and chemical properties of collagen make it a hypothetical source of a physiologic plastic substance that might be utilized by the tissue elements especially fibroblasts, and become part of the living tissue He presents a study of the histologic reaction of subcutaneous connective tissue, muscle, peritoneum, nerve tissue and bone of cats to implants of a collagen derivative obtained from

(8) Canad. J Research, Sect E, 27 94 104 April, 1949

bovine bone by treating it with dilute hydrochloric acid until all trace of calcium was removed This material was called collatissue A.

The various tissues studied showed relatively little reaction to implants First, there is proliferation of fibroblasts derived from the surrounding connective tissue around the implant to form a capsule Secondly a cellular infiltration consisting of large and small mononuclear cells occurs. These cells resemble lymphocytes. Few polymorphonuclear cells are seen, and in some specimens there are none. Giant cells are rarely encountered The cellular infiltration tends to be accompanied by a change in histologic structure of the implant the material becomes amorphous and stains more lightly these changes occurring mainly near the surface of the implant. Collatissue changed in this way is replaced by fibrous tissue

The mechanism by which the disappearance of collatissue A is accomplished appears to be complex The virtual absence of polymorphonuclear and giant cells tends to preclude a phagocytic process The change from a typical architecture to an amorphous material suggests an enzymatic attack on the material resulting in increased solubility and assimilation of the altered collagen The numerous mononuclear cells and young growing fibroblasts may play a part in this process

On the other hand specimens of silk, catgut and tantalum foil implanted as controls called forth a typical foreign body reaction in the various tissues of the cats In the case of silk and catgut especially the giant cells were so large and the nuclei so numerous that they resembled a syncytium.

Preliminary experiments failed to detect any antigenic properties for collatissue A

The experience gained in this study commends consideration of collatissue A as a source material in plastic repair of surgical defects and numerous other surgical procedures

Necessity for Tracheotomy in Treatment of Tetanus to Prevent Lethal Respiratory Complications is emphasized by Oscar Creech, J P Woodhall and Alton Ochsner[9] (Tulane Univ) in their plan of therapy

(9) Surgery 2 63 73 January 1950

METHOD —On first examination, date and type of injury and date and sequence of symptoms should be ascertained and a thorough neurologic examination made so that progress of the disease can be followed.

Tracheotomy is performed on admission if there is any oral difficulty, either trismus or dysphagia. In other cases if signs progress tracheotomy should be done before the need for it arises. Although useful in overcoming suffocating effects, it also permits aspiration of bronchial secretions which predispose to atelectasis and pneumonitis.

After skin testing for sensitivity, 50 000 units of tetanus antitoxin is given intramuscularly and another 50 000 units, diluted with 500 cc. 5 per cent dextrose in distilled water, administered intravenously All wounds, even though healed, must be excised. Cyclopropane or ethylene with curare is the anesthetic of choice. Pentothal® sodium should be avoided because of laryngeal spasm.

During the maintenance period the patient is placed in a darkened, quiet, single room with sideboards on the bed to prevent falls. Oxygen, suction machine and a respirator should be immediately available. From 5,000 to 25,000 units of tetanus antitoxin may be administered intramuscularly daily for five days. Excitability and convulsive seizures should be controlled by sedation. Phenobarbital is given in 1.5-2 gr doses every six hours as required. Avertin® 50 mg./kg., is given rectally every 12 hours as required and pentothal® sodium intravenously if convulsions occur The patient is fed by Levin tube if there is evidence of trismus or dysphagia. Heavy sedation precedes passage of the tube to prevent laryngeal spasm. Tube feedings consist of high carbohydrate, high protein mixture with vitamin supplements to provide 1,800-2,000 calories daily Tap water is added to bring the daily fluid intake to 3,000 cc. Whole blood is given as indicated. Penicillin (200 000-400 000 units daily) is given to prevent respiratory complications.

This method of treatment was evolved during the care of eight patients with tetanus, five of whom recovered Death occurred in two shortly after admission before therapy could be instituted and in one after nine days of treatment.

ANTIBIOTICS

Chloromycetin® in Surgical Infections W A. Altemeier and J Giuseffi[1] (Univ of Cincinnati) report on treatment of 100 patients with surgical infections due to a variety of organisms. Chloramphenicol (chloromycetin®) was given in doses of 25 100 mg /kg for 24 hours, depending on severity

(1) Surg., Gynec. & Obst 90 583-590 May 1950

of infection. During the acute phase doses were given at four hour intervals and after control of the infection at six or eight hour intervals.

In all but 2 of 23 cases of common pyogenic staphylococcic infections a beneficial result was obtained. Average duration of treatment was 6 7 days and average total dosage of chloramphenicol was 8 6 Gm

In anaerobic streptococcic infections, one spectacular result was obtained by chloramphenicol administered orally for 17 days in a patient with recurrent abscesses in the right breast with a burrowing sinus of three years' duration. A good result was obtained in a second patient with a chronic burrowing ulceration but in a third treatment failed.

Results of therapy in nine cases of pure gram negative bacterial infection were excellent in five good in two and questionable in two Recovery of one patient with Pseudomonas aeruginosa bacteremia and of another with pylephlebitis with Escherichia coli bacteremia was particularly noteworthy The effect of chloramphenicol was usually excellent or good in mixed gram positive and gram negative acute wound infections when surgical drainage or other indicated operative procedures accompanied chemotherapy In chronic wound infections of mixed bacterial etiology clinical response was less satisfactory However chloramphenicol therapy with surgical drainage gave good results in one patient with a Clostridium welchii infection of a postoperative abdominal wound. Variable response was noted in five cases of lymphopathia venereum One patient with facial blastomycosis was treated for 12 days with no evidence of beneficial response Symbiotic ulcers produced by hemolytic staphylococci and nonhemolytic anaerobic streptococci were successfully treated with chloramphenicol after other forms of chemotherapy had failed. There was little evidence of toxicity and no serious toxic reaction attributable to the drug occurred. Resistance of one or more species of bacteria to chloramphenicol occurred in 11 cases, developing 5-33 days after start of treatment. For this reason any surgical procedures which are indicated should be done early either during or before chloramphenicol therapy to prevent development of drug fastness.

Effect of Aureomycin on Bacterial Flora of Intestinal Tract of Man Contribution to Preoperative Preparation. Aureomycin is the most effective substance William H Dearing and Fordyce R Heilman[2] have found for removing bacteria from the intestinal tract of man. When aureomycin was given orally all bacteria culturable by usual methods, except proteus and Pseudomonas, were removed from the intestinal tract in as little as 1½ days. Fecal specimens of five untreated patients showed numerous bacteroides when cultured under anaerobic conditions for five days, whereas feces of patients receiving aureomycin showed no bacteroides. Perforated intestinal lesions associated with abscess cavities, intestinal fistulas of various types or intestinal obstruction hindered or prevented removal of all susceptible culturable bacteria from the intestinal tract

To prepare patients for intestinal surgery aureomycin should be given orally in 750 mg doses four times daily for 3 or 3½ days. Nausea, if it occurs, can be lessened by giving preparations of aluminum hydroxide orally or by feeding the patient when aureomycin is administered

Aureomycin and Blood Coagulation. In experiments with aureomycin administered orally to rabbits and cats, David I. Macht and Robert Farkas[3] (Sinai Hosp., Baltimore) found that in all animals coagulation time was markedly shortened Fourteen patients were then given one or two 250 mg capsules of the drug the usual clinical dosage in each some shortening of coagulation time was produced. Human controls did not show such changes after repeated blood examinations.

Tests made on human subjects and lower animals revealed no difference in prothrombin time, thus indicating that the diminution *in clotting time is due to other factors* involved in blood coagulation. Repeated tests of blood serums before and after administration of aureomycin revealed phytotoxic properties when tested by Macht's phytopharmacologic technic, as found in penicillin and streptomycin. Experiments now in progress with chloramphenicol indicate similar properties.

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(2) Proc Staff Meet., Mayo Clin. 25 87 102 Feb. 15 1950
(3) Science 110 305 306 Sept. 2 1949

The findings with aureomycin are *of practical clinical interest.* Although ordinarily nature provides a wide compensatory mechanism for prevention of thromboembolic accidents, the coagulatory apparatus may be considered to be in a metastable state so that sudden physiologic disturbances might *precipitate thromboembolic accidents.* Hence, suitable prophylaxis with anticoagulant drugs may be instituted.

Streptomycin, Aureomycin and Chloromycetin® Experimental and Clinical Comparison. According to George H. Yeager William L. Byerly Jr., and William A. Holbrook, Jr.[4] (Univ of Maryland) the major field of usefulness of chloromycetin® (chloramphenicol) and aureomycin appears to be in the treatment of infections with rickettsias and the virus agents of the psittacosis-lymphogranuloma group and gram negative infections. To compare the range of bacterial sensitivity of aureomycin and chloramphenicol with that of streptomycin and penicillin, they produced peritonitis of appendical origin *in a series of dogs*, since peritonitis in these animals is comparable to that in man. Animals treated with streptomycin, penicillin or aureomycin tended to develop a localized peritonitis, whereas controls and those treated with chloramphenicol did not.

Thirteen patients with peritonitis secondary to appendicitis were treated by surgery and aureomycin, and 3 with *presumptive peritonitis were treated by aureomycin alone* without a fatality In addition, three patients with intractable urinary tract infections and positive cultures for Escherichia coli were successfully treated with aureomycin.

Chloramphenicol has not been given a clinical trial from the surgical viewpoint except in lymphogranuloma venereum In this condition it will probably compare in value with aureomycin. Experimental data thus far obtained do not warrant its clinical use in peritonitis In infections with proteus organisms it should be of merit.

It should not be construed that antibiotics are a substitute *for surgery in treatment of peritonitis of appendical origin.* The experimental and clinical results suggest that aureomycin has a protective mechanism in this type of disease A combination of penicillin and aureomycin should be ex

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(4) Ann. Surg 130 576 588 September 1949

tremely effective when for one reason or another surgery is contraindicated or physical (environmental) conditions preclude its possibilities As a dual adjunct in surgical treatment, this combination should further reduce the present mortality rate If sufficient aureomycin is given to destroy Esch. coli, it is possible that smaller doses of penicillin would be effective

Intra-arterial Administration of Penicillin with Special Reference to Bone Marrow Concentration. Lester Blum and S. Stanley Schneierson[5] (Mount Sinai Hosp., New York City) studied penicillin concentrations in the bone marrow of the femur and tibia of young male dogs after intramuscular and intravascular injection. The highest peak levels usually occurred 10 minutes after an injection.

With single injections, bone marrow levels were higher after intravenous or intra-arterial than after intramuscular administration. Definite consistent differences between intravenous and intra arterial routes could not be demonstrated

When two injections of 2 000 units/kg each were given 20-30 minutes apart, a conspicuous elevation of penicillin concentration in the bone marrow was noted after the second injection This level exceeded by far that found after a single injection of the same total amount of penicillin. The marrow of all dogs which received an intra-arterial dose after a preliminary intravenous injection showed this distinct rise in concentration Three of five dogs given two consecutive intra arterial injections also showed considerable elevation in the drug level in the marrow If the two injections were given intravenously some elevation was seen, but it was not so pronounced as the increases after the other means of administration Thus, in almost every instance a noticeable increase in penicillin concentration followed a booster intra arterial dose given after a priming intravascular dose An intramuscular injection followed by an intra arterial one failed to produce any significant rise After the animals recovery the procedure was repeated on some dogs on the intact side, with the same results.

Rather poor results have been reported from penicillin

alone in chronic osteomyelitis. In view of their observations, the authors believe that higher penicillin levels in the bone can be obtained by booster intra-arterial injections than by any other method and that greater penetration will be favored thereby giving a better therapeutic result.

Intra-arterial injection need not be limited to administration of antibacterial substances Other physiologically active agents and other antibiotics may be utilized in the same manner and the method deserves more intensive investigation

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NEOPLASMS—GENERAL

Primary Retroperitoneal Tumors Summation of 33 Cases is presented by Harry R. Newman and Bernard D Pinck[6] (New York Post Grad. Med. School) About half the patients were aged 50-70 five were under age 10 Benign tumors, mostly lipomas, occurred in 16 per cent malignant tumors occurred in 84 per cent There were eight cases of lymphosarcoma, five of undifferentiated malignant tumor and three of neuroblastoma

The initial symptom in most cases was a sensation of vague discomfort, without any specific systemic manifestations Gastrointestinal complaints usually followed. Abdominal mass, pain and weight loss were also noted Average interval between onset and treatment was eight months.

In most cases, diagnosis was difficult. The chief physical finding was an abdominal mass of varying size and position. Various x ray studies were diagnostic in 53 per cent of patients Usual clinical laboratory data were of little significance *The commonest erroneous preoperative clinical impressions* were carcinoma of the transverse colon or stomach or fibroid uterus. The correct preoperative diagnosis was made in 37 per cent

All patients had an exploratory operation but in only 12 was the tumor operable In these total excision was performed In the others, inoperability was due to size of the tumor association with adjacent organs or widespread

(6) Arch. Surg 60 879-896 May 1950

extension. Those with lipoma had complete, unequivocal recovery. Among the others treated wholly by excision, four died within three months after operation. Of inoperable patients, 50 per cent died before being discharged. When total excision is impossible, x ray therapy should be used for tumors with any degree of radiosensitivity and for those with suggestive neoplastic alterations which cannot be totally excised.

Retroperitoneal Fatty Tumors. Report of Case and Collective Review of Literature from 1937 to 1947 are presented by Aaron A. Farbman[7] (Detroit).

Man, 52, had a 13.2 kg retroperitoneal lipomyxosarcoma removed. Postoperatively 500 cc. pooled blood plasma was given intravenously to combat shock. The patient made a satisfactory recovery, left the hospital on the fifteenth day, improved rapidly and gained weight. High voltage roentgen therapy was administered six weeks postoperatively. During and after this therapy he complained of persistent nausea and vague abdominal distress. Three months after operation, rapidly deepening jaundice developed, followed by coma and death. The most important autopsy finding was extensive acute necrotizing hepatitis, probably homologous serum jaundice produced by the pooled blood plasma. There was no evidence of tumor recurrence.

About 300 cases of retroperitoneal fatty tumor have been reported to date. Fifty three cases were collected from the literature from 1937 to 1947. Sarcomatous change was found in 47 per cent of this series compared to 14 per cent in von Wahlendorf's study (1921). The incidence of tumor was highest in the fifth and sixth decades. The over-all ratio of females to males was about 2:1; in benign tumors it was 4:1 and in malignant tumors 1:1. The largest tumor weighed 25.5 kg; average weight was 7.4 kg.

Helpful diagnostic aids are associated lipomatosis, difference in temperature of the lower limbs, roentgen evidence of displacement of viscera without intrinsic disease, radiolucency of the tumor and pyelographic evidence of displacement of the kidney and ureter.

In 5 of the 53 cases the tumors were inoperable. Of the 48 patients operated on, 4 died in the hospital (8.3 per cent). Of the remaining 44 there were follow up records for 25. Benign tumors had been removed in 14 and malignant tumors in 11. Thirteen, of whom six had been observed for

(7) Arch. Surg. 60:343-342, February 1950.

less than one year were living and well. Of the 14 benign tumors 6 recurred, 3 of these showing sarcomatous change Of the 11 patients who had malignant tumors, 6 died with in 18 months after surgery Two of the surviving five and four of the six who died had had postoperative roentgen therapy

Fibrosarcoma. Clinical and Pathologic Study of 60 Cases (23 in males and 37 in females) was made by Elwyn L Heller and William K. Sieber[8] (Pittsburgh) Although these tumors may arise from almost every tissue of the body, their origin is predominantly from deep fascial planes and from muscle and nerve sheaths of the trunk and extremities. In nine patients factors of possible etiologic significance included trauma, chronic irritation and pre-existing benign lesions. Development of malignancy in benign lesions was the most significant etiologic factor

The clinical course is unpredictable, of great variability and dependent on the growth peculiarities of the tumor itself and on its anatomic site The chief complaint was usually that of a palpable tumor mass, but in 18 patients pain was a prominent symptom. Duration of symptoms varied from several weeks to 32 years Follow up data were not available on 11 patients, but 37 were followed to death and 12 patients are living Average length of survival after appearance of symptoms was 31½ months and average time interval from appearance of symptoms to diagnosis, 11 months.

Grossly the tumors varied from the firm fibrous character of the well differentiated tumors to the soft fleshy hemorrhagic tissue of the more anaplastic types. Histologically they varied in cellularity amount of stroma, vascularity pleomorphism, cell maturity and frequency and character of mitoses There was no close correlation between histologic grading and clinical course

Of the 21 patients treated by surgical excision, recurrences are known to have developed in 11. In three a progressive increase in the degree of malignancy was demonstrated with each successive recurrence Of the 12 living patients, 4 have survived for more than three years Of these three were treated by radical excision and one by

(8) Surgery 27 539-545 April 1950

local excision and x rays. X ray therapy alone resulted in no cures.

Malignant Melanoma of Skin has been said to arise from pre-existing moles in about 65 per cent of cases, but the experience of Lauren V Ackerman[9] (Washington Univ) indicates a lower percentage He found that the most common mole to undergo malignant change was a brown, flat, hairless, soft mole which microscopically is often associated with junctional changes Prophylactically any mole should be removed which is subjected to chronic irritation or is undergoing increased pigmentation or growth, or ulceration Because of the high frequency of junctional moles on the genitalia and below the knee and of malignant melanomas, particularly on the legs such moles should always be removed, as well as any mole on the plantar surface of the foot or on the subungual area.

Clinically the usual malignant melanoma is readily recognized There is often a history of a pre-existing mole which darkened, increased in size and ulcerated. It is often elevated and is most commonly located on the head, neck or legs If a pigmented tumor occurs near the hairline or on the subungual area or leg chances are fairly good that it is a malignant melanoma Only relatively nonpigmented lesions engender difficulty In such instances a careful incisional biopsy will not be harmful. Probably one of the most difficult problems confronting pathologists is differentiation between a benign and a malignant melanoma.

Treatment of these tumors must be surgical. Irradiation has proved unsatisfactory for the tumors are truly radioresistant. Local excision by cold steel is preferable to cautery If the tumor is located fairly close to its draining lymph node group dissection in continuity seems justifiable Prognosis is good at the prepuberal age since the tumors are practically never malignant. It is good for the slow spreading malignancy often seen on the face in which regional lymph node dissection is not indicated, and for the tumor located on the head or neck in which radical excision is followed by regional node dissection. Prognosis is poorer when the tumor is located on a leg or on an area in which

(9) Texas Stat J Med. 44 735 744 November 1949

lymph node metastasis is not predictable, such as the abdomen.

Of 75 cases, 22 were hopelessly far advanced. There were only 21 patients in whom it was possible to do radical excision and radical lymph node dissection. Eight of these survived five or more years three of the eight had involved regional lymph nodes. Five year survival in this group does not mean cure, for it is common for the tumor to recur 10-15 years after removal of the primary lesion.

Xanthoma and Giant Cell Tumor of Hand are discussed by Thomas W Stevenson[1] (Columbia Univ) whose report is based on observation of 50 patients.

Giant cell tumors are usually hard lobulated and fixed



Fig. 5—Multiple xanthoma of hands (Courtesy of Stevenson T W: Plast. & Reconstruct. Surg 5 75-87 January 1950)

to ligaments, periosteum or tendon sheaths. They grow by expansion rather than infiltration and do not metastasize The overlying skin is thinned and sometimes adherent. On cut section color varies from orange to gray These tumors are not radiosensitive or amenable to nonsurgical therapy Excision is the treatment *of choice but there is a high re*

(1) Plast. & Reconstruct. Surg 5 75-87 January 1950

currence rate because the apparent capsule is often infiltrated by cells of the lesion so that complete removal is not always possible Microscopically these tumors show spindle-shaped connective tissue cells with collagenous fibers, multinucleated giant cells and large phagocytic cells which contain lipoid material.

Xanthomas often occur in young persons and sometimes on a familial basis. They may be associated with diabetes or hypercholesterolemia (500-800 mg /100 cc.) In some cases the cholesterol level can be lowered with subsequent disappearance of xanthoma nodules These tumors are usually multiple and are distributed symmetrically on the fingers (Fig 5) elbows, buttocks knees, ankles, heels and toes, with occasional scattered cutaneous nodules and eyelid deposits. The cutaneous masses are hard red to orange and nodular The overlying skin is usually adherent. Xanthoma tissue often infiltrates widely and without the apparent encapsulation of the solitary giant cell tumor Excision is seldom complete and recurrence is the rule, except in rare cases in which the blood cholesterol can be reduced. Management is often difficult because the blood supply is reduced and the growths are located over bony, thin-skinned prominences. Closure under tension frequently fails because resistance to infection is low Free grafts may be complicated by marginal recurrences. Ulceration or interference with function so that temporary relief is acceptable is a clear indication for surgery

Thermal Coagulation of Serum Proteins in Cancer in Postoperative Phase of Surgery and in Administration of Adrenocorticotrophic Hormone To determine whether an extensive and invasive cancer of the colon would yield a much lower index than a superficial basal cell carcinoma of the skin Oscar Bodansky and George F McInnes[2] (New York City) studied the relation between the type of cancer and the serum protein coagulability as determined by the value of the iodoacetate index or by the lowest protein concentration necessary to undergo thermal coagulation. They attempted also to ascertain whether the iodoacetate index could be used in determining the effectiveness of removal of a cancer and the onset of possible recur

2) Cancer 3 1 14 January 1950

rence It is well known, for example, that a decrease in serum alkaline phosphatase activity parallels removal of osteogenic sarcoma and a rise heralds its recurrence

The thermal coagulation of serum protein, as defined by the iodoacetate index, was determined in 68 healthy subjects, 68 patients with noncancerous disease and 137 with cancer The distribution of the indexes in these groups made it impossible to choose a range of iodoacetate indexes sufficiently inclusive of the values in healthy subjects and sufficiently exclusive of those patients with cancer to form the basis of a useful diagnostic test. Patients hospitalized with cancer had in general lower indexes than patients with cancer who were able to attend the clinics. Surgery on patients with or without cancer led to a decrease in the iodoacetate index level during the immediate postoperative period. Administration of ACTH led to a decrease in the iodoacetate index level and the values rose again when this administration was discontinued.

On the basis of these data and of certain reports in the literature it was concluded that the qualitative defect in the serum proteins, which is revealed by thermal coagulation tests, is not specific for cancer but is merely one manifestation of the organism's reaction to noxious stimuli.

[The thermal coagulation of serum proteins which was suggested by Charles Huggins of the University of Chicago as a test for cancer is thus found by Bodansky and McInnes not to be specific. Too bad! Someday such a test will probably be found.—Ed.]

Serodiagnostic Screening Test for Cancer is described by Irwin H. Olenik[3] (Bronx, N Y) With this test, accuracy in 46 cases of proved malignancies was 91 3 per cent and in 72 nonmalignant cases, 91.6 per cent

METHOD.—To each of three test tubes 1 cc. plasma is added. To test tube 1, 2 drops of 0.05×10^{-6} sodium fluorescein solution is added, and all tubes are stoppered with oil-silk paper and a cork. After 24 hours, 2 drops fluorescein solution is added to test tube 2. The tubes are rotated to mix the contents, wiped clean and exposed to Wood light rays so that only the most perpendicular rays strike the solution. If fluorescence in the tubes is the same, it is a negative reaction. With a positive reaction intensity of the fluorescence in tube 1 is diminished and the green element disappears leaving either the yellow or white. The difference is always distinct. Tube 2 is the control for comparing fluorescence changes which may have taken place over 24 hours. After 48 hours from the start of the test, 2

(3) New York Stat J Med. 50 573-575 March, 1950

drops sodium fluorescein solution is added to tube 3 and the procedure repeated as with tube 2, unless the reaction was positive after 24 hours. Changes after 48 hours are not significant.

Beginnings of Chemotherapy in Neoplastic Diseases. Ludwig Heilmeyer[1] (Univ of Freiburg) comments that the dramatic results and wide use of chemotherapy in bacterial infections have raised the hope that cancer might also yield to chemical agents and that methods evolved in bacteriostatic testing might be applied to neoplastic disease However the two conditions are not alike, in that bacteria are foreign to the body whereas cancer cells are endogenous and differ no more from normal than do the cells of one organ from those of another This makes selective action necessary, though difficult, such action is possible The most promising attack would be on mitosis the cells in the body which divide most rapidly the blood building cells, could be used as guides and if agents did not destroy them, the dosage would be safe

A second factor which makes attack on cancer cells difficult is the lack of resistance the human organism has toward them. The effect of chemical agents is not their destruction but a weakening and hinderance of their growth. For this reason radiation and chemotherapy cannot be expected to have more than temporary effects

Several groups of chemical agents have been employed in neoplastic disease (1) cytostatics such as colchicine acriflavine and arsenicals (they tend to lower resistance to infection) (2) agents which impede mitosis such as urethane, mustard gas and stilbamidine* (these may cause gastrointestinal disturbances) (3) carcinogenic agents, e g., benzpyrine and dimethylbenzathracene (4) metallic salts of copper nickel and cobalt (5) pyrogens and (6) hormones. Radioactive agents are physical and not chemical agents

Beneficial results have been obtained in leukemia and lymphogranuloma with urethane however complete cures have not been reported. Mustard gas affects lymphogranuloma lymphatic leukemia and some sarcomas favorably Skin cancer has been cured by benzpyrine Cystine and ascorbic acid compounds are said to block cell growth.

(1) Schweiz med. Wchnsch 9 530-547 June 18 1949

Pyrogenic agents cause involution of the tumor with substitution of connective tissue

Hormone therapy offers great hope in neoplastic disease. Hormone therapy of prostatic cancer gave encouraging results and led to an attempt on mammary cancer where it failed Combination of several chemical agents seems promising when one renders the cell sluggish and more susceptible to the effect of others

The satisfactory results to date are few but impressive Certain *basic principles have evolved*, and results of research should improve when the human tumor cell is cultured outside the body The final test, however must be on living man.

Migrating Thrombophlebitis Associated with Carcinoma. Edward A. Edwards[5] (Tufts College) reports six cases and reviews 23 from the literature The primary site of cancer was in the tail or body of the pancreas in 16 stomach in 4 lung in 4, gallbladder in 2 and undetermined in 3 Patients with this syndrome are of middle or old age and of both sexes However there is a predominance of men. The patient may present himself because of the venous disease without suspecting carcinoma. Inflammation of superficial veins of the legs or forearms is the usual initial complaint. Deep calf tenderness and edema suggest involvement of deep leg veins and pain over sacral or hip regions suggests pelvic phlebitis. *Thrombophlebitis appears at one or more sites at the outset.* Temperatures up to 100.5 F are common, though white cell count is generally unchanged The fever is not influenced by penicillin as in the usual nonseptic forms of thrombophlebitis Multiple pulmonary emboli are common but may be small and so unrecognized Once the process has started new attacks and exacerbation in previously involved segments occur rapidly until death There is a striking lack of arterial thrombosis

The cause of the thrombosis is unknown but there is no malignant infiltration of *the vessel wall* and *inflammation* of the wall is generally absent Clinically it must be differentiated from migrating phlebitis of thromboangiitis *obliterans* and from the more common idiopathic thrombophlebitis

(5) New England J Med. 240 1031 1038 June 30 1949

Treatment is secondarily important to the search for the responsible neoplasm Investigation of the pancreas, stomach and lung should be vigorous. Exploratory laparotomy should be performed if carcinoma is not established by other methods.

[This amazing condition is so impressive that one who has seen a case is not likely to forget it. Why there should be so remarkable a relationship between cancer of the body or tail of the pancreas and multiple venous thrombosis is something for which there is not the remotest explanation at the present time. Could it be that a specific thrombosing substance is liberated in a cancer which grows in that tissue? Again, there is the remarkable fact that only the veins and not the arteries, are the sites of thrombosis.—Ed.]

SKULL—BRAIN

Acute Subdural and Extradural Hematoma in Closed Head Injuries. Walpole Lewin[6] (Oxford) reports experiences in 29 cases of acute extradural hematoma and 21 of acute subdural hematoma. There were 15 deaths in the first group 2 because the hematoma was not diagnosed, 4 because of late intervention 3 because the hematoma was not found at operation, 4 because of cerebral contusion and 2 from other causes. There were 13 deaths in the cases of acute subdural hematoma 8 were due to cerebral contusion and laceration.

In 20 cases of acute extradural hematoma the findings conformed to the classic description After a head injury there was a short period of unconsciousness followed by a lucid interval. One half hour to three days later symptoms reappeared. In nine cases head injury was more severe there was no lucid interval and full consciousness was not regained Common signs in all cases were deterioration of the conscious level, scalp bruising or laceration over the hematoma localizing signs skull fracture, eye signs lucid interval pulse less than 60/minute, cerebrospinal fluid pressure over 200 mm or pineal shift in x rays. In 21 cases the hematoma was found in the temporal fossa, originating either from the main trunk of the middle meningeal artery or more commonly from one of its branches.

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(6) Ann Roy Coll Surgeons England 5 240-274 October 1949

Acute subdural hematoma most often follows a severe head injury with decided cerebral contusions. Cortical vessels are torn and blood enters the subdural space through tears in the overlying pia arachnoid. Other cases may follow laceration of one of the great venous sinuses. Most patients in this group had symptoms within 48 hours of injury. All patients lost consciousness initially, and in only nine was this for less than an hour. A car accident was the cause in 71 per cent; in none was injury due to a local blow to the head. Localizing signs so reliable in lateralizing extradural hematoma are unreliable in subdural hematoma. Diagnosis is complicated by underlying cerebral contusion and *bleeding into the subdural space which is frequently* bilateral. The latter occurred in 29 per cent of this series.

Once an extradural hematoma is *diagnosed operation* should be done immediately. The principle of burr hole exploration with subsequent enlargement if necessary is the generally accepted method. The correct site for initial exploration is indicated by the localizing signs, position of the fracture lines and site of scalp bruising or laceration. The whole head should be shaved to permit full inspection of the scalp and the making of several burr holes if necessary. If the clot is found at the first exploration and adequately explains the signs, routine exploration of the other side is unnecessary since bilateral extradural hematomas are rare. *In the uncomplicated case the dura need not be opened.* It should certainly be done when there is clinical evidence of underlying pathologic conditions as judged by an initial unconsciousness of an hour or more or presence of blood in the cerebrospinal fluid. A drain may be left in place 48 hours if there has been considerable oozing from the dura and if the dura has not come up flush with the bony defect so that a dead space remains.

A provisional diagnosis of subdural hematoma can usually be made, but if there are no localizing signs or a heavily blood stained cerebrospinal fluid has suggested subdural hematoma, a parietal burr hole is made. Since subdural hematoma is frequently bilateral, both sides should be explored. *Bleeding has usually stopped* by the time operation is performed so it is not customary to find a bleeding point in these cases. In most instances the hematoma is mainly

fluid, and on opening the dura the blood readily escapes. Usually a second burr hole is made on the same side as the hematoma and the subdural cavity is irrigated with warm Ringer's solution until the washings are clear. Since the brain usually begins to expand immediately to obliterate the dead space no drain need be inserted, but as an alternative the dura is left widely open and the subgaleal space opened by undermining the scalp incision so that any more blood may readily escape into this space and be absorbed. The wound is then closed in layers. When the hematoma is solid it may be possible by enlarging burr holes to remove it with suction and irrigation; otherwise an osteoplastic flap will have to be turned. A major operative problem is encountered when, after removal of the subdural hematoma, the cortex bulges through the dural opening. This may be due to localized brain swelling, existence of an extradural or subdural hematoma elsewhere, intracerebral clot or severe cerebral contusion. Presence of localized brain swelling further favors placing at least two burr holes on the side of the hematoma. If other hematomas are suspected the case must be reviewed from this aspect and appropriately treated. If, after evacuation of a subdural hematoma, a cortical clot can be seen through the burr hole it may be removed by suction after enlarging the bony opening. Such a procedure was attempted with success in three cases in this series. When an intracerebral clot does not present at the surface, routine exploratory needling is likely to be both dangerous and ineffective. Though severe cerebral contusions are not primarily surgical problems and many are essentially fatal injuries, in selected cases favorable results may follow subtemporal decompression or elevation of a frontal bone flap on the side indicated by the clinical signs, and removal of damaged brain and clot.

Although even those patients who recover well after evacuation of a surface hematoma do not usually regain full consciousness rapidly, failure to show some improvement after operation should be regarded with suspicion. The chief complications may be recurrent bleeding, low pressure state or cerebral edema. To be treated successfully recurrent bleeding must be recognized early and reoperation performed. Contrary to the usual postoperative

regimen for chronic subdural hematomas, the head down position is contraindicated in persons with acute cases because if the source of the bleeding has been venous the resulting increased venous pressure may well reinstitute it. The mechanism of the low pressure state is not well understood but the clinical picture may closely resemble that of a recurrent clot without lateralizing signs. Cerebral edema was not observed postoperatively in this series. Whereas local edema around damaged brain is common, general edema is uncommon in these cases and, if there is no cerebral damage does not occur in extra or subdural hematoma.

Of 12 patients with acute subdural hematoma and 26 with extradural hematoma who were followed for two to eight years, all returned to full time work or to school. Only four have had or continued to have epilepsy once the immediate effects of the acute injury were over.

Unilateral Prefrontal Lobotomy for Relief of Intractable Pain and Termination of Narcotic Addiction was carried out by John E Scarff[7] (Columbia Univ) in 83 patients. After follow up periods of 1 10 months it was ascertained that 22 patients had good results i e., they never voluntarily complained of pain or required narcotics postoperatively. Their preoperative pain arose from a variety of pathologic processes carcinoma of tongue jaw pancreas and bladder metastases of carcinoma to long bones, spine and pelvis neuritis of the cauda equina advanced arthritis thoracic aorta aneurysm atypical face pain, and trigeminal neuralgia. Results were fair in six patients and poor in five in whom the disease and its site were as varied as in the 22 with good results.

Pre and postoperative psychometric evaluations in 15 patients disclosed no significant differences between the scores of 11 whereas the scores of 4 showed lowering ranging from 18 to 23 points. *In each of the latter were factors* other than operation which might have contributed to the lowered score. Six given psychometric tests shortly after operation and repeated tests several weeks later showed a substantial gain over the first test. Evaluation of the principal categories of intellectual activity showed no charac

(7) Surg. Gynec. & Obst. 89 385-392 October 1949

teristic improvement or impairment in any field after unilateral prefrontal lobotomy Only 1 of 15 patients showed any decrease in social adjustment as evidenced by the Rorschach test In no instance did friends or relatives com

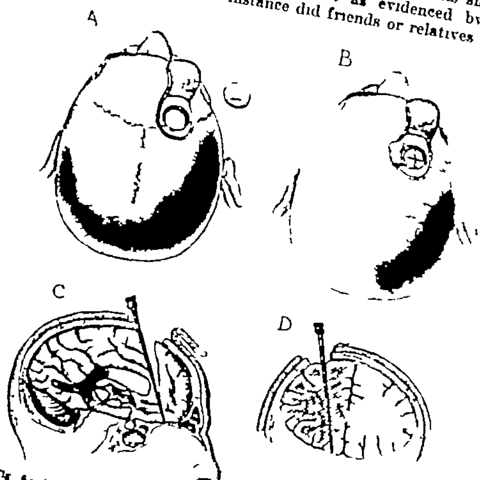


Fig 6.—Scarff's technic for performing unilateral prefrontal lobotomy under direct vision *A*, relation of incision and trephine opening to coronal suture *B*, cortical incision corresponds approximately to coronal suture *C*, anterior tip of lateral ventricle is located with ventricular needle and plane of section established immediately anterior to it *D*, in plane of section, white matter is divided in radial fashion until gray matter is everywhere encountered. (Courtesy of Scarff J E Surg Gynec & Obst 89 385-392 October 1949)

ment that the patient's personality had suffered because of operation, and in several improvement was striking

Unilateral lobotomy permitted withdrawal of narcotics without withdrawal symptoms in 15 patients addicted to use of drugs in varying degrees because of pain Withdrawal

symptoms lasted 72 hours and then receded in one patient An organic basis for the pain causing drug addiction was established for all but one patient.

A standard technic was used in all 33 patients. Lobotomy was performed under direct vision in a plane passing just anterior to the tip of the lateral ventricle and carried laterally, medially and ventrally (Fig 6) Thorough lobotomy can be performed only under direct vision. The operation produces amazingly little shock many of the patients are out of bed the day after operation and almost all by the end of the third day Unilateral lobotomy can be safely applied where more difficult technical procedures would not be tolerated

[At the Barnes Hospital we have had very worthwhile results with this procedure in cases of inoperable and painful cancer It has been found particularly useful in many cases of inoperable bronchogenic carcinoma associated with severe pain.—Ed.]

Revascularization of Brain through Establishment of Cervical Arteriovenous Fistula. Mental retardation, convulsive disorders and sensorimotor impairment are among the commonest pediatric problems. Gliosis, characteristic of these conditions has been found to interfere with blood supply to cerebral tissue Claude S Beck, Charles F McKhann and W Dean Belnap[8] (Western Reserve Univ) attempted to correct circulatory deficiency by producing an anastomosis between the common carotid artery and internal jugular vein, with resultant redistribution and increase of blood flow to the brain. The internal jugular vein was tied off and cut so as to prevent arterial blood from returning directly to the heart. Arterial blood thus traversed both artery and vein

Brain injury caused by mechanical trauma, anoxia, hemorrhage and vascular occlusion is characterized pathologically by decreased blood flow and glial tissue proliferation and clinically by mental deficiency convulsive disorders and sensorimotor impairment. Experimental and clinical support exists for the presence of viable but nonfunctioning neurons. Therefore patients chosen for the operation were those with brain injuries which often result in gliosis. In general, this included those showing mental retardation on an anoxic or arteriosclerotic basis and those with convul

(8) J Pediat. 35 317-329 September 1949

sive disorders on an organic basis, with or without mental retardation.

Ten children, aged 11 months to 14 years, with mental retardation, with or without convulsions, and an adult, aged 38 with mental deterioration and left hemiplegia, were operated on. Cerebral blood flow curves, plotted by a graph recording galvanometer attached to a Geiger counter after injection of radioactive protein bound iodine, showed a decided increase postoperatively Over all average of the arteriovenous oxygen differences of 10 controls was 6.1 volumes per cent, whereas that of the operated group was 7.1 volumes per cent.

In seven patients the postoperative period was not long enough for proper evaluation at the time of report. In four with follow up of one three and five months, surgery had obviously been beneficial. Complications such as pulsating exophthalmos, increased intracranial pressure and cardiac hypertrophy have not appeared. Should untoward results occur the fistula could be closed. The patients all demonstrated early and progressive postoperative improvement. Complete recovery is not anticipated only some returning function of viable neural tissue is expected.

FACE—BUCCAL CAVITY—PHARYNX

Harelip Denis Browne[9] lists the elements of complete double harelip which must be corrected

1. Failure of development of the columella The tip of the nose instead of standing right out from the skin of the lip is almost on a level with it and the columella is thus abnormally short. However it has a tendency to correct itself. If the tip of the nose is left free while the lip is pulled back into proper position, the forces thus set up will stretch the columella into a fair length. It is a grave mistake to try to lengthen it by putting into it skin that belongs to the lip

2 Failure of development of the labiogingival sulcus.

(9) Ann Roy Coll. Surgeons England 5 169 187 September 1949

part of the ala in its original place adherent to the maxilla (3) the gap in the bone needs a force to pull it together, and this can be supplied by the contraction in healing of the raw undersurface of the floor of the nostril that is left by simple joining of the surface

5 Cleft of the lip The best way to join the lip will be to imitate the manner of junction that should normally have occurred. Since muscles are involved in the cleft and their correct postoperative action is needed for a good result, they should be treated according to the orthopedic principles established in managing similar muscular gaps elsewhere. It is obviously impossible to imitate the process of lip formation, but three main principles emerge from consideration of it (1) no skin of the lateral portions meets

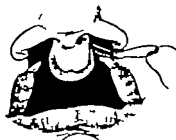


Fig. 9.—Stitching of floor of nostril. Linen mattress suture joins skin just outside the nostril on outer side to mucosa on septum just within it. (Courtesy of Browne D.: Ann. Roy Coll. Surgeons England 5:169-187 September 1949.)

below the central portion (2) the central portion forms no part of the red margin (3) the muscles meet and join under the skin of the central portion. The correct surgical formula should observe these principles and also take into consideration the present conventions of beauty of the human lip

Correction of the deformity consists of two stages. The object of the preliminary operation is to get the premaxilla firmly fixed in its correct position and to construct a proper labiogingival sulcus (Figs 7 and 8) The operation should be performed at about age 3 months and an interval of about one month should be allowed between it and the joining of the lip Figures 9-13 illustrate the various steps of the second operation to join the floor of the nostril and the lip itself

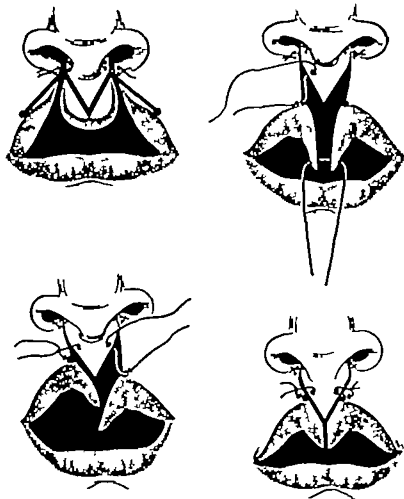


Fig. 10 (top left).—Cutting of the lip. Trephine holes are made level with tip of the V into which central portion has been cut, and are connected to raw surfaces stitched to septum by cuts with chisel-knife. Strips of skin attached to the hooks of mucosa thus formed are trimmed off with fine scissors.

Fig. 11 (top right).—Appearance when hooks are held down by temporary stitch and first stitch is inserted. It slopes acutely downward from center of the side of the central portion to trephine hole on mucocutaneous border.

Fig. 12 (bottom left).—First crucially important stitch is tied; this bends mucocutaneous line so as to form one half of a cupid's bow.

Fig. 13 (bottom right).—Essential shape of lip defined by two primary sutures. All that is now needed on anterior lip surface is fine adjusting sutures.

(Courtesy of Browne, D. Ann. Roy. Coll. Surgeons England 5: 169-187, September 1949.)

Epithelioma of Lower Lip. Evaluation of Dissection of Cervical Lymph Nodes. Edward S. Judd, Jr., and Oliver H. Beahrs[1] reviewed the 802 cases seen at Mayo Clinic from Jan. 1, 1930 through 1939 primarily to determine survival

(1) Arch. Surg. 59: 422-432, September 1949.

rates according to grade of malignancy and type of treatment to the neck 28 patients were inoperable when hospitalized and received only palliative treatment, 738 (95.3 per cent) received surgery for the primary lesion 14 (1 8 per cent) received radiation therapy and 22 (2.9 per cent) were not treated because previous treatment had been satisfactory Of 738 operated on, 2 died (0.27 per cent) Of 357 in whom bilateral suprahyoid neck dissection alone or with unilateral block dissection was performed 1 died (0.28 per cent) There were no deaths among patients in whom prophylactic neck dissection had been done Cervical nodes were palpable in 31 per cent half of them were small. Five year survival rates are shown in the table

FIVE YEAR SURVIVAL RATES IN EPITHELIOMA OF LOWER LIP ACCORDING TO TYPE OF TREATMENT TO NECK

Type of Treatment	Grades 1 & 2			Grades 3 & 4		
	Patients Traced†	Lived 5 Yr or More after Treatment		Patients Traced†	Lived 5 Yr or More after Treatment	
		No.	%		No.	%
Primary group						
No treatment	182	151	81.6	5	2	40.0
Prophylactic suprahyoid dissection	105	93	88.5	26	19	73.1
Prophylactic irradiation	55	46	83.6	6	5	83.3
Suprahyoid + block dissection	5	2	40.0	2	1	50.0
Irradiation	0	0	0	0	0	0
Total	347	295	85.0	39	27	69.2
Secondary group						
No treatment	60	51	85.0	4	3	75.0
Prophylactic suprahyoid dissection	106	91	85.8	31	24	77.4
Prophylactic irradiation	15	9	60.0	4	2	50.0
Suprahyoid + block dissection	13	6	46.1	13	6	46.2
Irradiation	1	0	0	3	0	0
Total	195	157	80.5	55	35	63.6
Total series	542	452	82.8	94	62	66.0

Primary group—patients who had not received previous treatment to the lips; secondary group—patients who had received previous treatment.
† Inquiry as of Jan. 1 1949 In 30 cases grade of malignancy was not stated.

For patients with clinical evidence of metastasis to the cervical lymph nodes, bilateral removal of the submaxillary

glands and lymph nodes and the submental nodes and unilateral dissection of the upper deep cervical nodes on the involved side are indicated. Block dissection of the anterior triangle of the neck with removal of the sternocleidomastoid muscle and the internal jugular vein is carried out when the upper deep jugular nodes are involved or the suprahyoid mass is large. Interstitial radiation is recommended when the nodes are considered inoperable or the lesion is grade 4. Prophylactic irradiation is considered a placebo.

For patients without clinical evidence of cervical metastatic lesions but with palpable nodes considered negative or without palpable nodes, prophylactic suprahyoid node dissection is recommended under certain conditions.

If the labial lesion is grade 1, neck dissection is not advised unless the lesion is of long duration, large, infected with considerable inflammatory reaction about it, and probably of secondary character. Most metastatic lesions are grades 2 and 3; therefore, prophylactic dissection of nodes is recommended in all except a few patients whose age or general condition does not permit major surgery. In an occasional case in which the grade 2 primary lesion is treated early and is small, neck dissection might be omitted. In early grade 4 lesions prophylactic neck dissection may be done, but usually there has already been metastasis and the lesions frequently are inoperable.

Factors favoring prophylactic dissection of cervical nodes are the opportunity for removal of early metastatic lesions, prevention of metastasis by surgical blocking off of the lymphatics, low mortality rate of suprahyoid dissection and high survival rate among patients so treated.

Combined Radical Cervicofacial Procedures for Primary Facial Cancer are discussed by Ian Macdonald[2] (Univ. of Southern California). Squamous carcinoma, melanoma or mixed salivary gland tumors of the parotid originating in the auricle or adjacent skin require radical surgery. From these sites a continuous chain of lymphatic metastases may develop. Metastasis starts first in the local periauricular nodes, then spreads in an almost arborescent pattern around or within the cervical tail of the parotid gland and thence to the adjacent submandibular lymph nodes. Lesions in or

(2) Surg., Gynec. & Obst. 90:16-20, January, 1950.

anterior to the auricle are more prone to metastasize into the anterolateral triangle, whereas those of retroauricular origin extend also into the posterior cervical triangle

Effective surgical treatment of these neoplasms requires application of the same principles of cancer surgery used elsewhere in the body Such application implies a certain disregard for the niceties of cosmetic end results With extensive lesions of the ear the entire ear must be removed, and sometimes tumor extension will necessitate mastoidectomy, ablation of the middle ear or resection of the mandible with temporomandibular disarticulation. Resulting defects in the area of the primary lesion can sometimes be reconstructed by use of sliding flaps from the adjacent skin or scalp, less commonly by immediate split or full thickness skin grafts

The extent of cervical block dissection should be as wide as is consistent with a reasonably low postoperative mortality and minimal impairment of function. Removal of the internal jugular vein and sternocleidomastoid muscle should be a part of standard procedure in any cervical dissection. Other neck structures may be removed, but the common and internal carotid arteries and the vagus, phrenic, lingual and hypoglossal nerves represent vital anatomic landmarks to be preserved intact. Dissection should begin at the level most distal from the primary site or at the floor of the supraclavicular space After dissection has been carried upward and the primary site widely and deeply excised the primary tumor is removed in one continuous block with the products of neck dissection. If closure is not possible the neoplasm is ulcerating or infected or there is periosteal or osseous involvement, cautery destruction of the primary tumor itself may be a superior technic

Among 13 patients treated according to these recommendations there was one postoperative death. Sufficient time has not elapsed postoperatively to permit evaluation of results.

Tumors of Salivary Glands Clinicopathologic Study of 160 Cases is presented by Arnold J Rawson John M Howard, Henry P Royster and Robert C Horn, Jr[3] (Univ of Pennsylvania) In the 100 cases of mixed tumor gross

(3) Cancer 3 445-458 May 1950

appearance was variable but encapsulation lobulation and a mucoid consistency were noted The common histologic feature was well differentiated, duct like structures. No tumor metastasized and only one showed any ability to invade locally In two patients seen only after onset of rapid growth, there was carcinoma with remnants of tissue having features of mixed tumor This suggests that carcinoma develops in 2 per cent of mixed tumors Local recurrence was observed in all sites except lip and pharynx after surgical excision of mixed tumors There was no correlation between recurrence and histologic pattern, age at onset, duration of tumor before treatment or tumor size on initial excision Of 45 patients operated on for mixed tumors of the parotid gland and followed for at least 10 years, local recurrence was observed in 14 The high incidence of local recurrence within one year after operation suggests that many recurrences depend on the growth of residual tumor

Papillary cystadenoma lymphomatosum of the parotid gland was seen in six instances. There was a gross intracystic papillary structure Microscopically papillary projections consisting of dense lymphoid stroma were covered by a well ordered layer of columnar epithelium with eosinophilic granular cells. These tumors were benign There were two additional tumors with the histologic picture of sebaceous glands

There were 17 cases of adenocarcinoma as epidermoid or undifferentiated carcinoma consisting of cords or broad sheets of tumor cells surrounded by varying amounts of fibrous stroma Minor degrees of differentiation were noted but such features did not alter the course or prognosis Most of these tumors were in the parotid gland Death occurred within six years after onset in 13 patients. The outstanding feature in most cases was extensive local growth and invasion of such structures as the mandible auditory canal and paranasal sinuses Metastasis to the lung occurred in two patients, to cervical lymph nodes in one and to the brain in one Radical surgical excision was used in two patients, one of whom also had radical neck dissection Both were apparently well seven years after operation. Most inoperable patients were given x ray treatment although the radioresistance of this tumor was recognized

Cylindroma occurred in 11 patients The characteristic

pattern showed groups of tumor cells enclosing one or more rounded spaces filled by pink staining colloid material. The cell groups were in a matrix having an appearance similar to that of the contained material. There was lack of encapsulation with invasion of surrounding tissues, often nerve sheaths After 8-23 years, four patients were dead, four were alive without evidence of disease after one to eight years and three with local tumor were alive at the time of the report Four patients in whom metastases occurred were definitely benefited by irradiation.

Malignant papillary cystadenoma was detected in four tumors of the parotid gland Distinguishing features were large amounts of mucin and frank invasion. One patient died after repeated excisions and receiving radiation therapy for 34 years another died within five years of onset.

Mucoepidermoid tumors characterized by simultaneous presence of mucin secreting cells and epidermoid cells were found in 12 patients. All eight with low grade lesions were living and clinically free from tumor 6-16 years after onset. All three with highly malignant lesions were dead within two years of onset two with widespread local disease and one with metastases. One patient, with a tumor of uncertain classification had four recurrences after repeated excisions and died with metastases. Combinations of surgical excision and x ray therapy were used

Certain clinical features observed in this series may be helpful in anticipating prognosis The median duration before treatment of mixed tumors in all locations was three to four years, considerably longer than was the case with malignant tumors. The peak incidence of onset of mixed tumors was in the third decade as contrasted with a peak incidence of highly malignant tumors in the sixth decade Onset incidence of tumors of low degree malignancy corresponded with that of mixed tumors Only 12 per cent of mixed tumors were painful, and only 1 per cent in the parotid gland produced facial nerve palsy Pain was a symptom with 48 per cent of malignant tumors, and facial nerve involvement was evident in 24 per cent when the primary site was the parotid gland.

Parotid Tumors in Children. John M Howard, Arnold J Rawson, C Everett Koop Robert C Horn and Henry P

Royster[4] (Philadelphia) studied records of 21 patients in whom parotid tumors first occurred before age 16

In two patients, chronic, recurring infection of the parotid and its duct had produced a fibrotic nodular gland, simulating a tumor This disease characteristically has its onset in childhood Exacerbations of acute swelling of the gland occur and are often bilateral If with such a history a patient has a nodule in the parotid, chronic parotitis should be considered and biopsy performed for confirmation if necessary since parotidectomy is often followed by permanent complete facial paralysis, biopsy is preferable initially

Hemangioendotheliomas occurred in five patients Vascular tumors are the characteristic tumor of the parotid gland in the first year of life occasional examples having been noted at birth. The hemangioendothelioma of infancy usually runs a benign course and does not have the ominous implications of the same tumor in adults. One tumor in this series was a fibrosarcoma Six were mixed tumors Mixed parotid tumors are considered nonmetastasizing neoplasms. Great variation in appearance and lack of uniform pattern is a common feature Although the mixed tumor characteristically begins in early adulthood it also occurs in childhood The six patients with mixed tumors were followed for 9-44 years no evidence of malignant change appeared in any of them but four had postoperative recurrence of the tumor

Lipomas occur in the parotid gland but none were found in this series. Papillary cystadenoma lymphoma is an encapsulated, usually small tumor which contains many small cysts 1 2 mm. in diameter or larger Its microscopic appearance is characterized by papillary epithelial structures resting on a lymphoid stroma Origin of this tumor is uncertain but most authors attribute the lesion to an embryonal malformation Most authorities agree that the lesion is benign.

Cylindroma, though malignant runs a slow course often 20 years or more It is locally invasive and metastasizes frequently but late to regional lymph nodes and to lungs A moderate amount of mucin is secreted. Invasion of nerve sheaths with resultant pain is frequent There was one cylindroma in this series. Mucoepidermoid tumors are char

(4) Surg Gynec & Obst 90 307-319 March 1950

acterized by simultaneous occurrence of mucin secretion and epidermoid features in a malignant epithelial neoplasm. There were two epidermoid tumors in this series, both of relatively low grade malignancy In two patients neuroblastomas of the cervical sympathetic chain were invading the lower pole of the parotid, and in another an accessory lobe of the parotid gland was mistaken clinically for a parotid tumor

The authors prefer to consider all tumors of childhood malignant until proved otherwise It is suggested that small discrete masses which do not involve the facial nerve be excised in toto for histologic diagnosis With larger lesions, biopsy is preferable

Direct Operative Removal of Benign Mixed Tumors of Anlage Origin in Parotid Region With Summary of Parotid Tumors in General. James Barrett Brown, Frank McDowell and Minot P Fryer[5] (Washington Univ) have used the



Fig 14 —Incision beginning near crus of helix extends down over tragus, under lobe of ear and into neck along a natural crease. A flap is raised far forward on the face to expose the entire gland and nerve distribution. Posterior edge may be raised as another flap (Courtesy of Brown, J B., *et al* Surg Gynec. & Obst. 90 257 268 March, 1950)

direct operative approach to the tumor in 75 patients. There has been no paralysis of the facial nerve and, in 10 years no evidence of recurrence All tumors were removed immediately following diagnosis. Endotracheal anesthesia was

(5) Surg. Gynec & Obst. 90 257 268 March 1950

usually used. The following technic gave optimal exposure of the area.

TECHNIC.—Incision is planned for maximal exposure and minimal ultimate scar It is started about at the hairline at the crus of

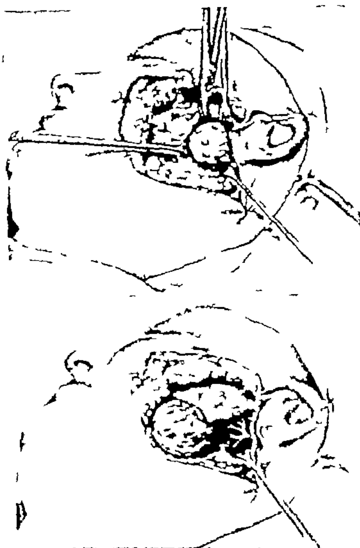


Fig. 15 (top).—Removal of tumor under direct vision of it and of any nerve branches in area. Gentle traction aids in dissection, with careful attention to deep surface where nerv may be adherent.

Fig. 16 (bottom).—Tumor and bed from which it has been removed, showing usual position of facial nerve beneath tumor If tumor is under the nerv the same process is used with constant attention t nerve branches and their preservation.

(Courtesy of Brown, J B., *et al* Surg., Gynec & Obst. 90 257 268 March, 1950.)

the helix continues down in front of the ear over the tragus, around under the lobe then turns into the neck along a natural fold (Fig.

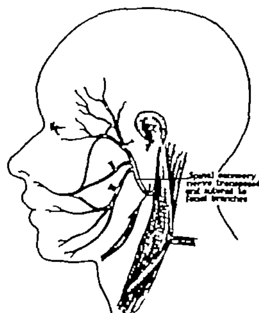


Fig 18 —Transposition of spinal accessory nerve and suturing to facial branches resulted in restoration f function after facial paralysis. (Courtesy of Coleman, C. C and Walker J. C.: Ann. Surg. 131:960-968 June 1950)

and the other behind the jugular vein to supply the trape zius If only the anterior branch supplying the sternocleido-mastoid is divided there should be no postoperative shoul der trouble

Excision of Mandible for Neoplastic Disease Indications and Technics. In a review of their material, Danely P Slaughter Erwin H. Roeser and Walter F Smejkal[7] (Chi cago) found that only 16 patients were operated on for tumors arising primarily from the mandible whereas 49 had resection of the jaw for tumors arising in adjacent tis sues in 35 of these the jaw was secondarily involved and in 14 it was not implicated but was resected to allow sur gical approach to intraoral cancer

The present surgical approach to intraoral cancer invad ing the mandible consists of radical neck dissection on the involved side with removal of the hemimandible and all adjacent involved soft parts in continuity repair is im

(7) Surgery 26 507 522 September 1949

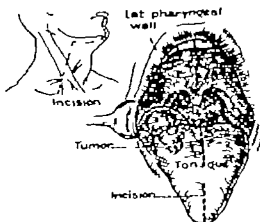


Fig. 19 (top) Fig. 20 (bottom)
(Courtesy of Slaughter D. P., et al. Surgery 26:507-522, September 1949)

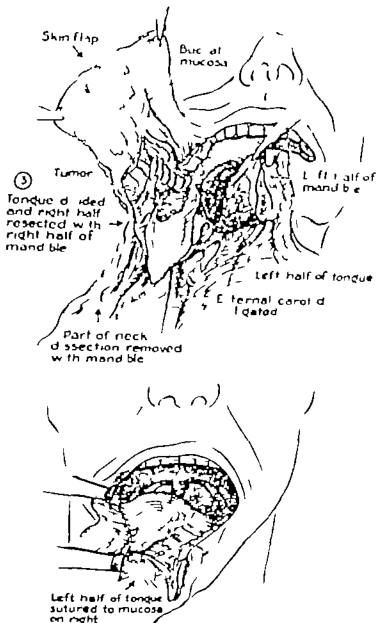


Fig 21 (top) Fig 22 (bottom)
(Courtesy of Slaughter D P et al. Surgery 26 50 322 September 1949)

mediate and a temporary tracheostomy is performed simultaneously The technic is illustrated in Figures 19 22 In Figure 19 the upper inset shows the skin incision and the lower drawing the intraoral soft parts incisions that can

be utilized in the situation presented Figure 20 shows the first stage of the operation as neck dissection is completed The upper or cheek flap is raised to an exaggerated degree only for anatomic demonstration. Figure 21 shows the procedure after section of the mandible and incision through the midline of the tongue Hemiglossectomy is done only if the tongue is involved by the tumor After this stage the mandible is disarticulated or sectioned posteriorly at the required level. Figure 22 shows the primary step in closure —suture of the medial cut edge of the intraoral soft parts to the buccal mucosa lining the cheek flap If partial glossectomy has been done as shown, the tip of the tongue should be left free if possible and the tip reconstructed by sutures this will greatly facilitate tongue function and improve the linguals in speaking The skin flaps are approximated with two or more Penrose drains strategically placed. Tracheotomy is then performed if it has not already been done

The palliation achieved by radical surgery in advanced intraoral cancer has been an unexpected dividend It is due chiefly to interruption of the cervical plexus and third division of the fifth cranial nerve plus removal of ulcerating infected and often necrotic cancer in the mouth. Restoration of normal function and symmetry is not as urgent as it might seem The primary repair results in a functional state compatible with maintenance of nutrition and usually allows weight gain and recovery to normal, so that all but two of the surviving patients have refused bone graft restoration. An obstacle to immediate attempts at restoration of bone continuity is the hazard of working with irradiated tissues. A dental prosthesis is the most practical compromise for patients who have had resection of half the mandible, but many of them are content to leave well enough alone and will not bother with a prosthesis.

Nonunion of Fractures of Mandible. Rainsford Mowlem[8] states that in most fractures clinical evidence of bony union should be obvious in less than two months. Any fracture should be immediately reduced, efficiently maintained and adequately protected against infection.

(8) Ann. Roy. Coll. Surgeons England 5:5 43 Jul 1949

In many fractures of the condyle and neck no fixation is required because the patient can reach and maintain normal dental occlusion. In fracture of the angle and ascending ramus the bulky muscles may be a cause of difficulties or a source of protection. Adequate reduction and splintage of the fracture line is the primary necessity. In fracture of the body and symphysis nonunion can most readily occur and the defect must therefore be brought under control at the earliest possible moment. The important factors which can convert potential risks into real dangers are delay in fixation, inadequate reduction, inefficient fixation, teeth or tooth remnants in fracture line and gross comminution of the mandible.

When a tooth is firm but partially exposed by the line of fracture, it is desirable to exclude it from the fixation so that it may be removed later if necessary. In comminution of the mandible the fracture is usually compound internally and externally. Although conservative treatment may achieve union after a long period in a few cases, it appears much more reasonable to accept the fact that nonunion is the probable result, to splint the main mandibular fragments in correct position, to open the fracture area widely, to remove all devitalized bone and to close the defect in the oral mucous membrane.

Treatment of nonunion may be expectant or reparative by bone grafting.

TECHNIC FOR BONE GRAFTING.—Through an incision just below the lower margin of the mandible, access to bone ends is obtained and the periosteum is stripped on the lower margin and buccal aspect. The scar tissue between the fragments is removed without entering the mouth. Dissection is continued up to the alveolar margin of each fragment and then down the lingual aspect anteroposteriorly about ½ in. All eburnated bone is cut away from the bone ends and a wedge of the outer aspect of each fragment is removed to create a large vascular surface with which the bone graft can make contact. The mandibular fragments are fixed in correct alinement, and the defect is bridged by the bone graft. This may be a solid graft but more often consists of cancellous chips from the iliac crest. A thin plate of cancellous bone is placed lingually to the bone ends to prevent transmission of movements of the muscles of the floor of the mouth to the cancellous chips. A satisfactory contour is built up, and the chips are retained by suturing subcutaneous tissues over them. The skin is closed as a separate layer. The splintage remains in position for four to five weeks. The graft is then tested for clinical rigidity and, if satisfactory, the splints are discarded.

Congenital Arteriovenous Fistulas in Mandible were encountered in two patients by Richard C. Clay and Alfred Blalock[9] (Johns Hopkins Univ) Persistence of embryonic communications between the primordia of arteries and those of veins seems to be the basis of congenital arteriovenous fistulas and probably accounts for multiple openings usually seen, in contrast to the single opening found in traumatic fistula. The head and neck are the commonest sites for persistence of such communications. Congenital arteriovenous fistulas of bone are uncommon and no such lesion in the mandible has been reported previously Surgical repair is advisable to prevent possible complications such as rupture with exsanguinating hemorrhage, sudden enlargement with gangrene of the part supplied cardiac enlargement with failure increased length of a limb, disfigurement due to a pulsating cirsoid mass or endarteritis with septicemia

When arteriovenous communications in bone are opened by dissection, removal of the entire involved osseous segment may be necessary to control profuse bleeding which comes forcefully from the large vessels which penetrate or lie in the bone In one patient extensive resection of the mandible was required to remove the fistula. Postoperatively there was good symmetry and good occlusion without the aid of a prosthesis. In the second patient a large tortuous artery was encountered as the external carotid artery was traced upward. Since occlusion of this vessel resulted in obliteration of the thrill and murmur interruption of the abnormal artery was considered preferable to resection of the mandible The artery was excised from its origin on the external carotid to its communication with the cirsoid mass in the mandibular defect A slight thrill and murmur over the fistula was noted three months postoperatively If progressive increase in flow through collateral channels occurs, mandibular resection will be necessary

X ray investigation of the mandible is advisable in any case of congenital arteriovenous communication in the face or neck whether or not pressure obliterates the thrill. If there is evidence of bone erosion, preparation for mandibular resection must be made since this is the only way to

(9) Surg., Gynec. & Obst. 90:543 546 Ma 1950

control bleeding and eradicate the fistulas. Such preparation should probably include dental impressions to be used, if necessary, in later preparation of a prosthesis

Anterior (Median) Pharyngotomy The procedure described by Calvin T Klopp and Adrian Delaney[1] (George

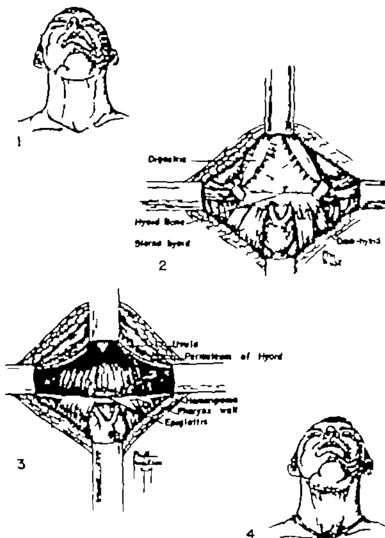


Fig. 21.—Anterior pharyngotomy 1 incision, 2 exposure of hyoid bone 3 pharyngotomy 4, closure of wound. (Courtesy of Klopp, C. T., and Delaney A. Arch Surg 60 1161 1170 June 1950)

Washington Univ) is useful for excision of a benign or malignant pharyngeal tumor implantation of interstitial

(1) Arch Surg 60 1161 1170 June, 1950.

radium into a nonresectable lesion of the pharynx, as a preliminary step in excision of certain tumors at the base of the tongue or when accurate anatomic diagnosis cannot be established by endoscopy Removal of the primary cancer is combined with removal of regional nodes *en bloc* when ever these nodes are involved by metastases

METHOD—Local anesthesia may be used or general anesthesia given through a previously constructed low tracheostomy opening or an intratracheal tube A transverse collar incision is made over lying the hyoid bone (Fig 23 *1*), which extends from the anterior border of the right sternocleidomastoid muscle to that on the left. Skin flaps are undermined 1 cm. above and below the incision, exposing the hyoid bone (*2*) The periosteum is incised 2 cm. on each side, freeing the central portion of the hyoid bone from muscle attachment, and the central segment is excised. The distal ends of the hyoid are retracted laterally and the pharynx entered through a transverse incision in the sulcus created by removal of the central segment of the hyoid. The superior pharyngeal nerve lying just below and the hypoglossal nerve just above the incision are easily visualized. The whole posterior pharyngeal wall is now exposed from the level of the arytenoids to the uvula (*3*) For closure the tongue base is approximated to mucous membranes of the anterior surface of the epiglottis with interrupted sutures. This is reinforced by suturing mylohyoid and geniohyoid muscles to the sternohyoid and thyrohyoid muscles. The platysma muscle and skin are approximated. No drainage is used (*4*) If tracheostomy is performed at the original operation, adequate airway is insured at all times. Post operative care includes administration of 300 000 units of penicillin daily for seven days. Oral feedings are not permitted the first 48 hours. A suction machine should be immediately and constantly available to assure patency of the tracheostomy Diet is advanced as rapidly as tolerated. When the patient can withstand corking of the tracheostomy tube for 24 consecutive hours, the tube is removed. Sutures are removed in three to seven days.

Pharyngeal Neurilemmomas of Cranial Nerve Origin Medial Displacement of Internal Carotid Artery as Diagnostic Sign. Danely P Slaughter and Frederic A de Peyster[2] (Chicago) report four cases the tumor arose from the vagus nerve in three and from the hypoglossal in one The patients presented a syndrome not previously described that consisted of (1) a bulging firm submucosal tumor in the posterolateral pharyngeal wall causing dysphagia and, later interference with the airway, (2) pulsation of the mass due to medial displacement of the internal carotid artery and (3) interference with function of the involved

(2) Arch. Surg. 59 384-397 September 1949

nerve (two of the patients with vagus tumor had paralysis of the vocal cord on the same side)

In two cases diagnosis was made by aspiration biopsy These lesions are benign encapsulated tumors that are best

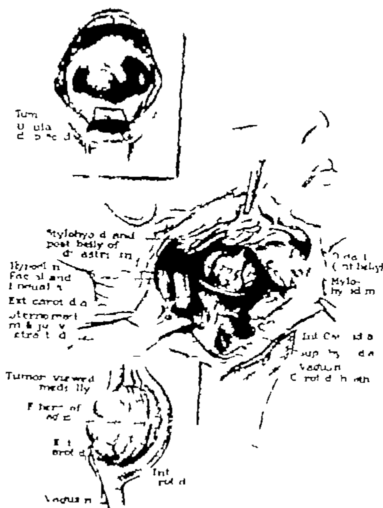


Fig. 24 —Composite and diagrammatic reconstruction of appearance of tumor when exposed through external cervical approach. Upper insert, intraoral view showing bulging mass lower insert, relation of vagus nerve to tumor (Courtesy of Slaughter D. P., and d Poynter F A. Arch. Surg. 59 386-397 September 1949)

extirpated through an external cervical approach (Fig 24) Irradiation is not only useless but harmful. The principal hazard in excision is hemorrhage, which can be prevented or controlled best by a wide exposure identification and

retraction of vulnerable vessels and their dissection under direct vision. The pharyngeal mucosa can be dissected free without penetration, allowing the operation to be done with out contamination. Actually dissection of these tumors by the external approach is facilitated by the displacement of important structures by the tumor If completely excised, neurilemmomas do not recur locally but occasionally they show malignant tendencies.

Plasma Cell Tumors of Upper Respiratory Tract Clinicopathologic Study with Emphasis on Criteria for Histologic Diagnosis was made by Arnold J Rawson Paul W Eyler and Robert C Horn, Jr[3] (Univ of Pennsylvania) Nine plasma cell tumors which had initial manifestations in the upper respiratory or alimentary tracts were compared with nine cases of primary multiple myeloma and numerous miscellaneous inflammatory lesions composed largely of plasma cells In general, the six clinically malignant tumors had characteristics comparable to those of myelomas, whereas the three benign lesions resembled chronic inflammatory processes.

In inflammatory lesions normal plasma cells are distributed throughout the tissue with a definite but uncharacter istic, pattern. They have no especial relation to the stroma. There is no replacement of tissue by plasma cells for they merely lie within other tissues.

The absence of certain diagnostic features of malignant plasma cell tumor which makes the presence of malignancy unlikely include (1) orientation of plasma cells in broad sheets on a delicate stroma consisting largely of capillaries, and (2) replacement of other tissues by such plasma cell sheets in contrast to their disposition throughout another tissue All clinically malignant plasma cell tumors in this series showed these characteristics they were not observed in any benign lesion These features are particularly well brought out by silver staining Characteristics which, when present to a significant degree, strongly suggest malignancy include alterations in the nuclear-cytoplasm ratio nuclear characteristics such as large red staining nucleoli and mul tinucleated cells. Mitotic figures in plasma cells usually in dicate malignancy The absence of Russell s bodies is not a

(3) Am. J Path. 26 445-461 May 1950.

reliable criterion of malignancy Absence of group 2 characteristics is not evidence of the benign nature of a plasma cell tumor

Benign plasma cell lesions of the upper respiratory tract may be adequately treated by surgical excision. Malignant plasma cell neoplasms respond well to radiotherapy Malignant lesions treated by surgical removal usually recur

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NECK

Thyroglossal Tract Abnormalities Cysts and Fistulas, Report of 105 Cases from Johns Hopkins Hospital Observed during Years 1926 to 1946 is made by Grant E. Ward, James W Hendrick and Robert G Chambers[4] (Baltimore) Thyroglossal cysts and fistulas arise from epithelial rests in the remnants of the thyroglossal duct which are produced by the descent of the thyroid anlage from an evagination in the pharyngeal floor They may be found either in the midline or slightly to one side In this series 60 per cent occurred between birth and age 10 Sex incidence was about equal. There was a cyst in 59 per cent, sinus tract in 34 per cent and a palpable subcutaneous duct in 19 per cent.

These abnormalities are important because they are often the seat of recurrent inflammatory disease or are a cause of cosmetic disfigurement. The cyst contents are mucoid unless infection causes purulent change It should be remembered that these abnormalities may occur anywhere from the foramen cecum in the base of the tongue to the suprasternal notch and that they are the most frequent cysts occurring in that area. Varying amounts of thyroid tissue may be found in the cystic mass or closely associated with it Branchial fistulas or sinus tracts are easily differentiated because they lie on the side of the neck and not just to the right or left of the midline Either may communicate with the oral cavity but thyroglossal abnormalities do so at the foramen cecum whereas branchial fistulas open at Rosenmüller's pouch in the lateral pharyngeal wall. Visualization of the tract is possible radiologically with lipiodol® instillation

(4) Surg., Gynec. & Obst. 89 727 734 December 1949

Treatment of thyroglossal abnormalities is complete excision of all epithelial tissue Incision and drainage should be performed only if the cyst is infected and requires drainage Most of these lesions will eventually become infected and should therefore be removed. In this series 51 per cent of patients gave a history of infection at some time in the course Injection of sclerosing solution or x ray therapy are contraindicated

METHOD.—Endotracheal anesthesia should be instituted. A transverse incision 5-8 cm. long is made over the cyst or an elliptic transverse incision made around the opening of the sinus or fistula. The

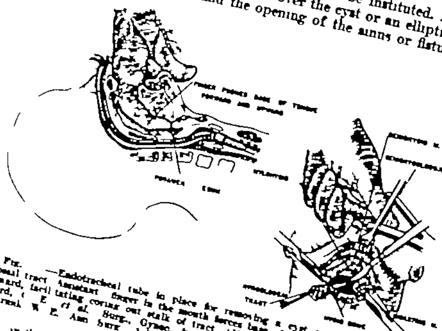


FIG. —Endotracheal tube in place for removing a cyst or fistula from thyroglossal tract Assistant finger in the mouth forces base of tongue and foramen cecum forward, facilitating coring out stalk of tract (Modified and redrawn.) (Courtesy of Ward, G. E. et al. Surg., Gynec. & Obst 89 72 724 December 1949; from Sistrunk W. E. Ann Surg 1 121 1925.)

cyst or fistulous tract is followed to the level of the hyoid bone the central portion of the bone freed above or below and 1 cm. of the hyoid directly adjacent to the tract removed with a generous block of tissue around the tract. Tension will pull forward the centrally freed portion of bone (Fig. 25) An assistant's finger placed in the mouth, exerting pressure against the base of the tongue forcing it forward, greatly facilitates removal of a core of tissue including the muscles around the stalk of the tract right up to the foramen cecum The tract may be followed to the base of the tongue and removed with no untoward effect. A single purse-string suture of fine chromic catgut will close the defect at the foramen cecum, inverting the mucosa into the mouth The musculature of the tongue is brought together in the midline with interrupted sutures of fine silk or chromic catgut The severed edges of the hyoid bone are brought

gether with catgut sutures placed directly through the bone if the patient is young or through the periosteum if the patient is an adult. A small rubber dam drain may be placed deep in the muscle of the tongue to facilitate postoperative drainage, and skin edges are approximated with subcuticular and end-on mattress sutures of fine silk.

None of the 28 suprahyoid lesions recurred after surgery In 34 of 77 which occurred at or below the hyoid, an adequate section of bone was removed 6 per cent recurred. However in 43 no bone was removed, and 25 6 per cent recurred.

Lateral Lymphoepithelial Cyst of Neck ("Branchial" Cyst) E S J King[5] (Melbourne) chose the term lateral lymphoepithelial cyst on the basis of the characteristic histologic appearance observed in 76 cases. A few midline cysts have a similar structure, but the word lateral differentiates this group from them. These cysts show a considerable range of variation in position and structure, so there must be a definite criterion for those which are to be included in the group The criterion is the histologic structure of the wall an epithelial lining with subjacent lymphoid tissue is invariable in some part, if not the whole of the cyst wall.

The cyst commonly lies under the anterior border of the sternocleidomastoid muscle at the level of the bifurcation of the carotid arteries it may project for some distance between these vessels. It ranges from a small, firm, even tense, unilocular structure to a larger one which may be lax and multilocular The thickness of the wall varies greatly and in part determines the consistency of the structure. The internal lining may be smooth but is often irregularly mammillated Internally there is often some trabeculation. The contents vary from a clear fluid containing some cholesterol crystals (rarely mucinous) to a pultaceous semisolid material. Microscopically the cyst is usually lined with squamous epithelium immediately beneath it is lymphoid tissue Often it is impossible to separate the epithelial from the lymphoid cells with certainty In places strands or crypts of epithelial cells penetrate into the lymphoid tissue and appear to merge with it Morphologically this underlying lymphoid stroma is sometimes found to be thymus.

(5) Australian & New Zealand J Surg. 19 109-121 November 1949

There is a close relation between the cysts and lymph nodes and lymphoid tissue which is of fundamental importance Apart from the occasional protrusion of the deep part of a cyst between the two carotid arteries, there is no constant or even frequent association of the cysts with vessels or nerves. Cysts are sometimes associated with the sinuses. The following factors all have a bearing on the mode of cyst formation and should be looked for in neck structures, either in the presence or absence of cysts (1) presence of epithelium in lymph nodes (2) primary squamous cell tumors of lymph nodes, and (3) relation of epithelium to lymphoid tissue

The principal hypotheses of origin of the cysts are that they arise from remnants of a branchial cleft, precervical sinus or thymic duct There is no real evidence supporting any of these hypotheses, but some deductions may be drawn from the structure of some cysts In most, epithelium is stratified and mature, however, in a few in which there is cellular variation the cyst does not appear to arise from preformed epithelium. The single layer of flattened cells merging gradually into a stratified epithelium, its occurrence in sinusoids and its position in the middle of some nodes make an origin from endothelial cells reasonably certain. This applies also to the epithelium found in lymph nodes apart from the cysts The indications therefore are that the epithelium arises from cells which, at the time the cyst is forming are structurally at least a part of lymphoid tissue In some cases the supporting tissue is thymus in these it may be assumed that the epithelium arises from the cells of Hasall's corpuscles. The mode of development of this scattered thymic tissue requires further study The cysts have no direct relation with any of the structures in the early embryo Any terminology suggesting this is misleading and should be discarded.

Branchiogenic Anomalies Results of 70 Cases Observed at Johns Hopkins Hospital between 1926 and 1946 are reported by Grant E Ward, James W Hendrick and Robert G Chambers[6] (Baltimore) Branchiogenic cysts and fistulas may occur at any age and in patients of any race or either sex.

(6) West. J Surg 57:536-549 November 1949

Bilateral fistulas are common in the region between the supra auricular area and the angle of the jaw Fistulas are usually present from birth and most have their external orifices situated along the anterior border of the sternocleidomastoid muscle in the lower third of the neck Symptoms are usually an annoying continuous or intermittent discharge of mucus and recurrent attacks of inflammation

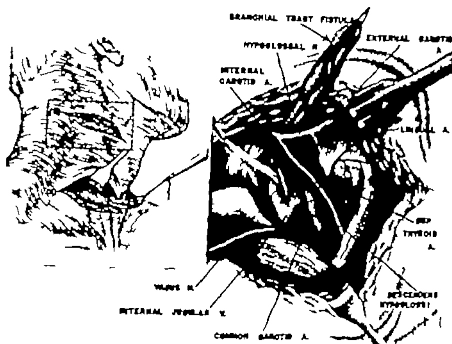


Fig. 20 —Insert redrawn to show stepladder incision in neck for removal of branchiogenic fistula. Incision B of insert is enlarged to show direction of branchial tract fistula to pharyngeal wall. (Courtesy of Ward G E et al West J Surg 57 536-549 November 1949; from Bailey H Brit J Surg 21 173 October 1933)

in the fistula with periodic obstruction Fistulas may occur below the level of the hyoid The tract can be easily visualized radiologically after injecting it with lipiodol[*] Complete surgical excision of the fistulous tract is the most rational therapy

Method.—An elliptic transverse incision is made about the external orifice after a purse-string suture has been placed about it. Gentle traction is applied and the tract is followed up beneath the skin, platysma muscle and fascia with dissecting scissors, and a second transverse incision made over the tract on a higher level (Fig 20) The tract is then threaded through the first to the second incision and the dissection begun anew and continued until the tract

has been completely removed If the tract extends to the pharynx, one finger is placed in the mouth and pressure applied over the pharyngeal wall opposite the tract entrance facilitating dissection into the pharynx (Fig 27) If possible the entire internal orifice should be invaginated into the pharynx by a purse-string suture and the wounds closed in the usual manner A drain may be placed in the lower wound for two or three days.

Branchiogenic cysts usually occur at the angle of the jaw but may be seen at any location from in front of the external auditory canal to the clavicle An insidious, painless and at first inconspicuous swelling develops. The lining

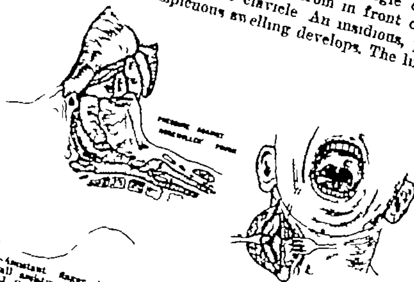


Fig. 27 — Assistant finger placed in the mouth produces pressure over the lateral pharyngeal wall assisting dissection of branchiogenic fistula. (Courtesy of Ward, G. E., et al West J Surg. 57 536-549 November 1949)

epithelium may be either squamous or stratified columnar The latter type may possess cilia and usually does after repeated infection Aspiration of a previously uninfected cyst yields thick, transparent mucoid fluid with the odor of sebaceum, signifying that columnar epithelium lines the cyst An opaque watery or milky fluid indicates that the cyst is lined with squamous epithelium. It is from these characteristics that diagnosis can often be made Branchial cleft cysts should be treated by complete extirpation of all epithelium bearing tissues

METHOD —The best approach is through an incision over the most prominent part of the cyst, but parallel to the anterior border of the sternocleidomastoid muscle Since the cyst may have deep attachment adequate exposure is necessary Rupture should be

avoided, especially in the superior medial border in which the cyst is deepest, for if any epithelium is left it will cause recurrence. Any incomplete fistulous tract which may extend to the pharynx must also be removed

Branchiogenic carcinoma may develop from a previous cyst It usually presents a picture of squamous cell carcinoma In this series there were seven cases in which it was located between the angle of the jaw and the level of the thyroid cartilage In six cases the patients were over age 50 *The best treatment is radical surgical excision with* radical neck dissection of regional lymph nodes. The magnitude of the procedure depends on the extent of the growth. Resection of the common carotid artery should be approached with caution because cerebral complications from ligation or resection of the vessel occurs in 12-25 per cent of cases depending on the patient's age and may vary from psychoses to death.

Facial Distortion in Wryneck Prevented by Early Resection of Fibrosed Sternocleidomastoid Muscle. James Barrett Brown Frank McDowell and Minot P Fryer[7] (Washington Univ) state that wryneck (torticollis) probably results from injury to the sternocleidomastoid muscle during delivery especially if there is a breech presentation. Stretching tearing and possibly necrosis of muscle fibers occur with dense fibrous tissue replacement

The contracted muscle pulls the head over to the involved side, making the ear close to the shoulder twists the chin around to the other side and tilts it upward. The mass may be palpable Before treatment observation should extend over six months to determine whether there will be spontaneous recovery or damaging increase in deformity Excision of the whole fibrosed muscle will relieve the deformity without producing too noticeable an irregularity of the contour of the neck. If operation is delayed until childhood, it can still be done with hope of obtaining an excellent result.

PROCEDURE.—Open ether anesthesia is used in babies and intratracheal anesthesia in older children A short collar incision 5 cm. long is made just above the clavicle over the mass. The platysma is opened and the external jugular divided if necessary The sternocleidomastoid mass is exposed by dissection under a skin and platysma muscle flap to allow retraction over the length of the con

(7) Plast & Reconstruct Surg 3 301 309 April, 1948.

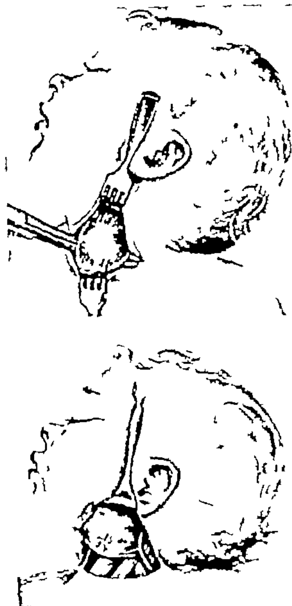


Fig. 28 (top).—In surgery for wryneck, muscle is carefully separated from jugular vein, carotid artery and vagus nerve.
Fig. 29 (bottom).—Elevation and removal of fibrosed muscle.
(Courtesy of Brown, J. B., et al.: Plast. & Reconstruct. Surg. :301-309, April, 1950.)

tracted muscle. Dissection is carried carefully around the muscle anteriorly and under it to avoid the internal jugular vein, carotid artery and vagus nerve (Fig. 28). Both heads of the muscle may be divided from the clavicle if necessary. The muscle is gently elevated and separation carried upward underneath it, avoiding the deep

structures and saving the eleventh nerve (Fig 20) The branch to the sternocleidomastoid muscle may be cut. The twelfth nerve is avoided as the dissection is carried up and the muscle is detached close to the mastoid. In older patients, structures in the cervical fascia, scaleni or trapezius muscles may be shortened secondarily and must be freed so that the head can be moved to any position. If only one head of the sternocleidomastoid muscle seems to be involved, the operation may be limited to this site but secondary procedures may be required. The wound is closed with fine sutures in the platysma muscle and skin. A small rubber drain may be left in. A pressure fixation dressing of mechanics waste and elastic adhesive is applied casts, braces or other appliances are not necessary The child's activities provide the best physical therapy Further treatment is not necessary although follow up should be carried out.

Costoclavicular Compression Relation to Scalenus Anticus and Cervical Rib Syndromes Compression of the subclavian artery and brachial plexus nerve trunks may occur at one of three places behind the scalenus anticus muscle, between clavicle and first rib and beneath the pectoralis minor muscle These three conditions are diagnosed by three separate maneuvers the Adson maneuver shoulder attention position and hyperabduction of the arm John M Mc Gowan (Tufts College) and Morris Velinsky[8] (Kilgore Tex) show that many symptoms attributed to the scalenus anticus muscle are actually due to costoclavicular compression The neurovascular structures passing to the arm are intermittently compressed as in a vise the jaws of which are the clavicle and the cervical or first rib This compression is readily produced by a test in which the pulse to the arm is greatly reduced or shut off when the shoulders are placed in the soldiers' attention position.

With the Adson maneuver presence of the scalenus anticus syndrome is implied if systolic pressure, recorded first with the shoulder placed forward and upward, shows a reduction of 20 points or more when the head turned to the side being studied is thrown back and a deep breath taken. Many patients when tested for scalenus anticus syndrome by the Adson maneuver automatically push the shoulder down and back, occluding the pulse by costoclavicular compression thus suggesting a scalenus anticus syndrome Section of the muscle may give some benefit because of increase in size of the costoclavicular space,

(8) Arch Surg 62 73 Jul 1949

but the erroneous diagnosis may account for some of the disappointing results reported.

Of 21 patients who complained of vascular and neurologic disturbances of the arm, 14 had a costoclavicular compression syndrome. In all, the pulse was reduced in volume or completely occluded when the shoulders were placed in the attention position. Of 108 presumably normal controls, only 4 had positive reactions to tests and 3 of these had the costoclavicular syndrome. Only one patient who was symptom free gave a positive reaction, which indicates that the test is over 99 per cent accurate.

Among the 14 patients with costoclavicular compression syndrome, there was a specifically positive reaction to the Adson maneuver in only 5. This indicates that in these five there was fibrosis of the scalenus anticus, probably from intermittent pinching of the muscle between clavicle and first rib.

Some patients were benefited by exercises aimed at strengthening the levator scapulae and trapezius muscles, although follow-up was not adequate. If exercises fail, scaleniotomy and removal of the cervical rib or a portion of the first thoracic rib is recommended. Excision of the middle third of the clavicle is another possibility in intractable cases, but it has not been tried.

THYROID—PARATHYROID

Pathogenesis of Hyperthyroidism. Peter Heinbecker[9] (Washington Univ.) states that hyperthyroidism results from excess hormone production either by localized thyroid acinar cells in an adenoma or by overactivity of the acinar cells of the whole thyroid gland. This overactivity is caused by increased amounts of thyrotrophic hormone. Increased production of this hormone, which is secreted by the basophil cells of the glandular hypophysis, results from an increased secretion of the neurohypophysis, which is under control of fibers from the supraoptic and paraventricular hypothalamic nuclei. The hypothalamus, including these two nuclei and the

(9) Ann. Surg. 130 604 25 October 1949

autonomic nervous system centers, is subject to excitation and suppression from the central nervous system As a consequence of exteroceptive and interoceptive impulses which reach the central nervous system, the neurohypophysis may be influenced Persons differ constitutionally with respect to the degree to which this chain of events activates the hypophysis The action as such is normal for regulation of visceral functions This concept is based on experimental data as well as on clinical observations

Rate of Conversion of Administered Inorganic Radioactive Iodine into Protein Bound Iodine of Plasma as Aid in Evaluation of Thyroid Function. Dwight E. Clark Robert H. Moe and Evelyn E Adams[1] (Univ of Chicago) gave I^{131} orally to patients with varying degrees of thyroid function. Those who were thought to have normal or a low thyroid activity received 0.5-1.5 mc. Those who had an elevated basal metabolic rate and presented the classic clinical picture of hyperthyroidism were given a large tracer dose or a therapeutic amount of radioactive iodine, the latter dose varying from 3 to 8 mc. according to the estimated size of the gland. No patient was fasted or on a special diet Many of the patients were studied in the outpatient department. Blood for determination of the total amount of radioactive iodine in a given amount of plasma and the percentage of this which was protein bound was drawn in exactly 24 hours Results were expressed as the ratio of radioactivity in counts per second in the protein fraction to total plasma radioactivity in counts per second This was designated the conversion ratio, which was determined as soon as possible after the basal metabolism test was obtained.

Twenty-eight patients with hyperthyroidism were studied Conversion ratio ranged from 45 to 96 per cent (average, 78 5) Only one patient showed a turnover of less than 50 per cent he had discontinued propylthiouracil two weeks before the test and had minimal signs of recurrence if four weeks had been allowed to elapse before determining the conversion ratio he would probably have had a ratio above 50 per cent. There seemed to be a relative correlation between severity of hyperthyroidism and conversion ratio There was no overlapping between the upper limit of normal and hyper

(1) Surgery 26 331 340 September 1949

thyroidism At present, all patients with a conversion ratio of 50 per cent or higher are considered to have hyperthyroidism.

Twenty two euthyroid patients were studied 16 had disease unrelated to the thyroid 3 benign adenoma 2 carcinoma of the thyroid, treated by partial thyroidectomy and 1, severe malignant exophthalmos but no thyrotoxicosis. Range of conversion ratio was 13-42 per cent (average 24)

The expected low conversion ratio in hypothyroidism or myxedema was confirmed in 19 cases the range was from 2 7 to 12.5 per cent (average 6) Patients who convert less than 10 per cent are considered to have abnormally low thyroid activity

In seven patients who had hypertensive cardiovascular disease with elevated basal metabolic rate the conversion ratio was under 10 per cent placing them in the hypothyroid range This would suggest that the body had suppressed the action of the thyroid to decrease metabolic activity and thus reduce work of the heart. Two patients with essential hypertension converted 36 and 23.8 per cent, placing them in the euthyroid group

Histologic Localization of Absorbed Radioactive Iodine in Some Human Thyroid Diseases is reported by Frederick L Krentzer Earl R Miller Mayo H Soley and Stuart Lindsay* (Univ of California) A tracer dose of I^{131} was administered to patients with various thyroid diseases. One to five days later operation was performed and uptake of iodine in removed tissues determined by Geiger counter and by radioautography

In 13 patients with nodular goiter the microscopic picture varied from frank hyperplasia to marked involution of nodules Measurement disclosed that the greater the hyperplasia the greater the uptake of iodine Total uptake of the involuted gland was about 20 per cent of the administered dose while in the hyperplastic gland uptake ranged from 40 to 60 per cent With intervals of three days or less from ingestion to operation most of the iodine appears in the cells but with longer intervals appreciable quantities appear in the colloid. Small uptakes were noted in one simple and one fetal adenoma.

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*) Arch Surg 60 707 20 April, 1950

In four cases of thyroiditis total uptake was less than 9 per cent of the administered dose. Radioautographs showed uptake largely confined to whatever groups of normal appearing cells remained. Areas of lymphocytic infiltration and disorganized acinar structure had no demonstrable uptake

There was little evidence of radioiodine uptake in either metastatic or primary sites in 14 of 15 cases of thyroid carcinoma *The exception was in a patient with well differentiated* thyroid carcinoma and pulmonary metastasis of 20 years' duration. Uptake was substantial in tissue from the primary tumor and from an area of lymph node metastasis in the neck. These findings suggest that radioiodine will probably be of limited value as the sole therapeutic agent for treating carcinoma of the thyroid

Benign and Malignant Epithelial Tumors of Thyroid Gland were studied by Leo M Zimmerman, David H. Wagner, Harold M. Perlmutter and George D Amromin[4] (*Michael Reese Hosp*) *Of 1 871 thyroid glands surgically* removed 102 contained true benign tumors or adenomas and 52 malignant tumors

Only two types of adenomas were recognized the papilliferous which comprised 70 per cent and the simple which comprised 30 per cent The papilliferous adenoma consists of cuboidal or columnar cells with clear or eosinophilic cytoplasm arranged on a stalklike structure of fibrous tissue with a vascular core The simple adenoma includes all those composed of either cords of eosinophilic cells or masses of very small acinar structures which are devoid of colloid. The term fetal adenoma was abandoned as misleading Delineation by a capsule was not necessary for classification as an adenoma. All nodules containing colloid filled acini were excluded from the category of adenoma these tumors represented 5 4 per cent of the specimens studied In most cases, adenoma was found incidentally in glands removed for other indications. About three-quarters were 1 cm. or smaller in diameter

Most malignant tumors were entirely unsuspected before operation Of 38 patients followed 23 were alive and well 1 13 years postoperatively 6 were living up to 6 years but *had metastases and 9 were dead 6 from carcinoma of the* thyroid

(4) Arch. Surg. 60 1183 1191 June 1950

Of patients with carcinoma, survival rate was highest in the 23 with papillary adenocarcinoma Of 21 patients followed, 12 were well 3-13 years postoperatively and 3 were dead Only three of six patients with adenocarcinoma were well one to three years postoperatively another was living with metastases and the other two were dead Results in patients with carcinoma simplex or undifferentiated carcinomas were even less satisfactory

The term malignant adenoma is applied to tumors with insufficient positive evidence for diagnosis of malignancy In most of these lesions there is some proliferative activity with mitotic figures and cellular pleomorphism, but no evidence of blood vessel or capsular invasion. Of six patients with this disease four were well one to five years postoperatively one was living with metastasis two years after operation and one had died of carcinoma of the thyroid within six months.

Blood vessel invasion was found in 19 of 52 cases of carcinoma Survival for five years or more occurred in 26 per cent of these whereas 27 per cent of 33 patients without blood vessel invasion lived for a similar length of time Apparently blood vessel invasion is not necessarily a dire prognostic sign

All nodular goiters which produce symptoms either of thyrotoxicosis or of compression should be removed Nodular masses showing evidence of increasing size or firm consistency are also excised. Fixation of the thyroid mass indicates carcinoma unless inflammation can be demonstrated as the cause Papillary carcinoma may be treated with partial or subtotal thyroidectomy if local recurrences develop reoperation is still possible with considerable promise of success. Radical neck dissection is done if local metastatic lymph node involvement is present at reoperation. X ray therapy may be used postoperatively Nonpapillary types of thyroid cancers are treated by hemi or total thyroidectomy with radical dissection of one or both sides of the neck in selected cases. Postoperative irradiation is probably advisable

What Thyroid Nodules Are To Be Feared? In trying to answer this question Oliver Cope Brown M. Dobyns, Edward Hamlin, Jr., and James Hopkirk[5] (Massachusetts Gen'l Hosp) analyzed carcinomas of the thyroid seen during 1937 48 with results shown in Tables 1 and 2. Starting in 1944

(5) J Clin Endocrinol. 9 1012 10 2, October 1949

every patient with a single nodule or unilateral abnormality of a single area of the thyroid was operated on for removal of the nodule or localized abnormality, even if it was believed benign In 150 patients, incidence of malignancy was 19 per cent The low reported incidence of carcinoma in nodular goiter in autopsy statistics is due to the small number of patients with such disease who die in the hospital.

Despite accurate physical and laboratory examinations, *satisfactory diagnosis of thyroid lumps often cannot be made*

TABLE 1.—CARCINOMAS ENCOUNTERED 1937-48

Type	No.	Av Age of Patient	Age Range
Papillary	62	46	16-76
Alveolar	24	48	17-62
Undifferentiated	27	58	32-80
Epidermoid	2	62	56-67
Lymphoma	1	65	
Retic. cell sarcoma	2	65	55-76
Metastatic	12	56	39-74
Total	130		

TABLE 2.—ORIGIN OF CARCINOMAS METASTATIC TO THYROID

Rectum	2
Thyroglossal duct	2
Lung	1
Esophagus	2
Kidney	2
Larynx	3
Total	12

without exposure and even biopsy At times definitive clues may be obtained from the delphian node lying in the midline of the neck just above the upper border of the thyroid isthmus and in front of the middle cricothyroid ligament It is *normally not palpable When carcinoma is present the gland* may be palpable At operation, the gland is sought removed and opened if carcinoma is found radical operation is undertaken without cutting into the primary lesion in the thyroid gland Diagnosis may also be helped by the finding that, after administration of radioiodine, solitary nodules which emanate more activity than surrounding tissue are likely not to be malignant, whereas those with less activity may harbor carcinoma.

Carcinoma of Thyroid in Children Ten Year Follow up Hugh F Hare and Richard V Newcomb[6] (Lahey Clinic) review five cases of thyroid cancer in children, aged 6-13, who have been followed for 13 18 years. They have seen only 12 cases of this disease in children.

The five patients have shown a few points in common the most important being the long survival time a finding also reported by other writers Also important was the fact that many years after removal of the primary tumor pulmonary metastases of similar appearance developed in two patients. Histologic study of the tumors showed no startling consistency In one case considerable variation in the type of malignant cell was found at different examinations and at different times In one specimen three malignant cell types were identified Adenocarcinoma was the most common variety of malignant growth and occurred in some form in four of the five cases

The two patients with metastases to the lungs had different pathologic pictures. The fact that cancer arose in lateral aberrant thyroid tissue in both may be of some significance In two patients, after the original tumor had apparently been cured, multiple colloid adenomatous goiters developed possibly on a compensatory basis

Radiation therapy is indicated as an adjuvant to operation in treatment of all carcinomas of the thyroid. In three of the four patients in whom it was used regression of the recurrent or metastatic lesion occurred. Any nodular mass in the region of the thyroid in children should be suspected of being malignant until proved benign by excision and biopsy Distant metastases in carcinoma of the thyroid do not necessarily portend an unhappy outcome

Carcinoma of Thyroid Contributions to Its Clinical Picture, Histopathology, Treatment and Prognosis Arne Bertelsen, Erik Christensen and Viggo Eskelund[7] (Copenhagen) analyzed experience with 92 females and 26 males, most of whom were aged 40-80 Symptoms such as rapid growth, changed rate of growth, pain fixation, hoarseness or Horner's syndrome indicate a grave prognosis, for all are characteristic of late stages of carcinoma of the thyroid. Weight loss

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(6) Radiology 54 401-406 March, 1950
(7) Acta chir Scandinav 99:205 224 1949

is not rare and when found in cases of nontoxic goiter should suggest malignancy

Histologic examination was made in 96 cases and in 72 the material was reviewed. Metastases to lymph nodes were found in 70 per cent to viscera in 36 per cent and to bones in 18 per cent. The carcinomas were classified as adenoma with invasive growth, 6.9 per cent adenocarcinoma of papillary or alveolar type 43 per cent carcinoma simplex of small cell or giant cell type, 37.5 per cent and miscellaneous tumors such as spindle cell carcinoma or fibrosarcoma 12 6 per cent

Follow up was possible in 116 cases The tumor was regarded as inoperable in 55 Total hemithyroidectomy was performed in 6 and subtotal thyroidectomy enucleation and resection in 55 The five year survival rate was 29 per cent and the 10 year rate 21 per cent Reports in the American literature indicate a 5 year survival rate of 50-62 per cent and a 10 year rate of 43 per cent This difference is attributed to the European attitude that nontoxic adenomas should not be treated surgically and to the infrequent use of total thyroidectomy with neck dissection in cases of carcinoma of the thyroid

Carcinoma of Thyroid Gland Grant E Ward J W Hendrick and Robert G Chambers[8] (Johns Hopkins Hosp) reviewed 112 consecutive cases and found that the disease may occur at any age and is one of the more frequent cancers of the neck in children. There were 74 female and 38 male 82 white and 30 Negro patients. It is conservatively estimated that from 4 to 20 per cent of discrete adenomas develop into cancer irrespective of age however the younger the patient the greater is the danger of malignant transformation In 87 patients (77 per cent) thyroid abnormality preceded the symptoms of cancer 20 had an aberrant position of the apparent initial tumor indicating that the corresponding lobe of the thyroid was involved by a low grade cancer Hyperthyroidism symptoms were present in 30 (26 per cent) but only 24 (21 per cent) also had a basal metabolic rate above +15

The cases included 61 low grade malignancies (36 adenomas with blood vessel invasion and 25 papillary cystadenomas) 37 moderate grade malignancies (20 papillary adenocarcinomas, 11 alveolar adenocarcinomas and 6 Hürthle cell carci

(8) Ann. Surg 131 473-493 April, 1950.



Fig. 30.—Lymphatic drainage of thyroid gland. (Courtesy of Ward G. E., et al.: Am. Surg. 131:473-498, April, 1950; after Rouvière H.: Anatomy of Human Lymphatic System [Ann Arbor Mich.: Edwards Bros., Inc., 1938].)

nomas) and 14 high grade malignancies (5 small cell carcinomas, 1 giant cell carcinoma 3 epidermoid carcinomas, 4 fibrosarcomas and 1 angiosarcoma)

The lymphatic system of the thyroid begins as a rich, delicate network of lymphatic channels around the follicles, extending peripherally through the gland into collecting trunks which drain into six groups of nodes. The multiplicity of directions of lymphatic flow from the various parts of the gland account for the extensiveness of node metastases. If possible

the area of the gland that is primarily involved should be determined to evaluate the probable *extension of metastases* (Fig 30) Metastases may develop via the blood stream or the lymphatic channels from malignant adenoma The regional *nodes were involved in 17 of the 20 cases of papillary adeno-*carcinoma (85 per cent) and, together with distant nodes in many instances in 39 cases of the entire series (34.8 per *cent) All metastases from malignant adenoma and* papillary adenocarcinoma were limited to one side of the neck.

Surgical eradication of every adenoma is mandatory When *frozen* section reveals evidence *of* malignancy the authors' policy is to do a hemithyroidectomy with preservation of the recurrent laryngeal nerve and radical neck dissection extending up to the digastric muscle. The operative technic is essentially that developed by Lahey

TECHNIC.—The usual collar incision is made and elongated up the involved side of the neck *to the mastoid process. The skin flaps* and platysma muscle are dissected widely The sternocleidomastoid muscle is severed above the clavicle and below the mastoid process to give access to the internal jugular vein, which is then ligated above the clavicle and below the mastoid process. The omohyoid muscle is severed and, since thyroid cancer invades blood vessels, the jugular vein and its tributaries from the thyroid gland, together with the fascia containing lymph nodes, are *rolled medially to the lateral* border of the thyroid gland. The recurrent laryngeal nerve is dissected out the superior and inferior thyroid arteries ligated, and the strap muscles severed from their upper and lower attachments. The thyroid lobe and isthmus are removed. To prevent the possibility of postoperative edema, swelling or hematoma, all involved tissue adherent to the trachea must be removed leaving the trachea bare.

Lesions that have extended from the lower pole of the thyroid to infiltrate the structures in the superior mediastinum are not removed surgically Tracheostomy is per*formed at completion of the operation. Irradiation is begun* about 10 days or 2 weeks later It is also given in inoperable cases and for local recurrences. It has been of definite value *in reducing the size of the parent lesion and holding regional* metastases in abeyance Local recurrence in the regional nodes only is treated by surgical excision and postoperative *radiation. Experimental work is being conducted on radio-*active iodine.

Prognosis will be improved by routine removal of the benign *thyroid adenoma which is the precursor of cancer in*

80 per cent of cases. A good prognosis is encountered in cases developing from discrete or multiple adenomas.

Cancer of Thyroid Ten 20 Year Follow up of 198 cases is presented by Hugh F Hare and Ferdinand A. Salzman[9] (Lahey Clinic) The clinical findings of early cancer are so strikingly similar to those of single adenomas and thyroiditis that biopsy and histologic evaluation are necessary for differentiation In this series single thyroid nodules were malignant in 10 per cent of patients on whom operation was done. This incidence is high enough to warrant removal of all single tumors. Associated hyperthyroidism was noted in 16 patients with cancer This finding may be significant since all these tumors were diagnosed before the days of radioactive iodine. Because of the recent finding of several cancers in patients with hyperthyroidism who were treated with radioactive iodine or radiation some investigators are afraid to use these substances.

There were 49 cases of alveolar adenomas with invasion. All tumors were removed surgically, and most of the patients received postoperative x ray therapy The 10 year survival rate was 38 7 per cent and the 20 year rate 10.2 per cent

Papillary adenocystoma with invasion was encountered in 48 patients and papillary adenocarcinoma in 38 The 10 year survival rates were 47 9 and 52.6 per cent and the 20 year rates 4.1 and 10.5 per cent respectively These tumors should be removed surgically, and if there is lymph node involvement radical neck dissection should be carried out. If there has been invasion of the trachea and muscles, x ray treatment should be used postoperatively Metastases may be inhibited for many years by x ray therapy even though the tumor does not entirely disappear The tumors thus far described are those most likely to respond to radioactive iodine.

Of 24 patients with alveolar adenocarcinoma, 20.8 per cent survived 10 years and none survived 20 years. These tumors did not respond to irradiation in the same fashion.

The alveolar tumor if it accepts radioactive iodine, may be curable, but it probably contains enough anaplastic cells which will not accept radioactive iodine to make it advisable to use x ray therapy and in some cases radium, in addition

9) Am. J Roentgenol. 63:381-388 June 1950.

to radioiodine. Radium implantation may be of value in localized fixed lesions

There were 30 patients with small cell and 9 with giant cell tumors. Two of the former and one of the latter survived 10 years Small cell tumors are radiosensitive, and if diagnosis can be made early and treatment instituted there should be improvement in results. Giant cell tumors have not been sensitive to any amount of radiation which normal tissue will tolerate.

Best results have been accomplished by radical surgery supplemented by some sort of radiation therapy

Carcinoma of Thyroid Gland was encountered by Warren H Cole, Danely P Slaughter and James D Majarakis[1] (Univ of Illinois) in 54 of 663 patients having thyroidectomy for nodular goiter in the past 11½ years, an incidence of 8 per cent. Incidence of carcinoma in toxic nodular goiter was only 1 per cent in contrast to 17.15 per cent in nontoxic nodular goiter Statistics on cancer including all types of goiter are misleading because the incidence is so low in toxic goiter Attempts to determine the incidence of cancer in goiter from autopsy statistics are worthless, since many patients seen in the clinic die at home and do not come to autopsy

The danger of cancer in goiter is about three times greater in men than in women. Average age of patients with carcinoma of the thyroid is much lower than that of patients with other types of cancer Most carcinomas begin in benign nodules or adenomas as indicated by the fact that average duration of the mass in this series was 6.1 years.

The preoperative diagnosis in early cases is difficult. During the past four years a correct diagnosis was made in not over 75 per cent of patients with carcinoma even with the advantage of a biopsy in a few cases. Rapid increase in growth of the nodule a feeling of pressure, hoarseness, persistent cough, difficulty in breathing and an indurated tumor mass help in making the diagnosis the first symptom is the earliest and the remainder are usually indications of metastases or invasion outside the gland.

When the cancer has invaded the capsule of the gland or metastasized to cervical lymph nodes, it should be treated by radical neck dissection and radiation therapy sometimes in

(1) Surg., Gynec. & Obst. 89:349-356, September 1949

cluding use of radon seeds. Reports of other investigators indicate that radioactive iodine will be of only slight help in controlling the disease.

Owing partly to the different criteria used in making the microscopic diagnosis and partly to geographic locations, five year survival rate varies from 61 to 7.8 per cent in seven reports reviewed by the authors. In their series it was 38 per cent but will probably be lower in their more recent cases, since 11 of 16 patients observed during the past four years are already dead.

Incidence of cancer in the solitary type of nontoxic nodular goiter is so high in the authors' locality that they advise removal of all solitary nodules, but perform subtotal hemithyroidectomy rather than enucleation because early cancer is found unexpectedly in a surprisingly large number. Despite this procedure, the percentage of cancer has not decreased from that in their initial series reported four years ago.

Nonencapsulated Sclerosing Tumors of Thyroid were observed in 5 men and 20 women by John B. Hazard, George



Fig. 31.—Irregular white, nonencapsulated tumor of thyroid adjoining capsule. (Courtesy of Hazard, J. B., *et al.*: J. Clin. Endocrinol. 9:1216-1231, November 1949.)

Crile Jr., and William S Dempsey[2] (Cleveland Clinic) Twenty three were found in thyroids removed because of hyperthyroidism 19 of the glands were hyperplastic Two were discovered incidentally at autopsy Follow up studies were possible on 17 patients, all of whom were without recurrence for periods of five years or more after operation.

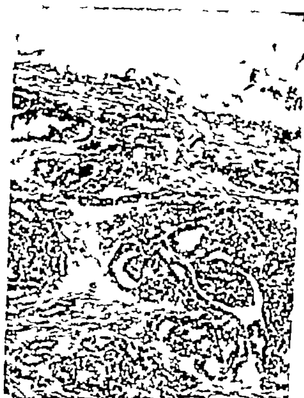


Fig 32.—Small cuboidal cells in acinar and papillary arrangement, infiltrating thyroid capsule; reduced from × 70 (Courtesy of Hazard, J. B., et al. J Clin. Endocrinol. 9 1216 1231 November 1949)

Grossly the capsular surfaces of the thyroid lobes were smooth and of the usual color, or when the lesion adjoined the capsule there was an indefinite small pale patch. Sections revealed a small, firm or hard white yellowish or gray circumscribed but not encapsulated lesion (Fig 31) which varied from 2 to 20 mm in diameter Microscopically all but one of the tumors was papillary with acinar elements of variable size. The epithelial cells were columnar or cuboidal and of

(2) J Clin. Endocrinol. 9 1216-1231 November 1949

small or medium size (Fig 32) They resembled the usual cell type found in papillary carcinomas which metastasize to the lateral cervical region. The thyroid tissue adjoining the tumor was invaded slightly in 18 cases and moderately in 1 The most characteristic low power configuration was that of an irregular rounded papillary *tumor with abundant fibrous* stroma marginated by thyroid lobules, arranged so as to produce a scalloped appearance and separated by irradiating bands of stroma continuous with that of the neoplasm. In about two thirds of the cases the capsule adjoined the tumor and in 11 was microscopically infiltrated, although there was never extension into the tissues adjoining the thyroid

It is important that the innocence of nonencapsulated sclerosing tumor of the thyroid be recognized and appreciated Although the genesis of these benign tumors is unknown, patients having them should not be subjected to radical operation or x ray therapy

Intrathoracic Goiter Its Incidence, Symptomatology and Roentgen Diagnosis. In 6½ years, among 908 thyroidectomies performed at Massachusetts General Hospital, James J McCort[3] found 28 intrathoracic goiters (3.1 per cent) 20 of which were partially and 8 completely within the thorax. Only those whose major portion lay within the thorax were considered intrathoracic all extended to or beyond the aortic arch. Ages of the 28 patients (14 men and 14 women) ranged from 35 to 75 only 3 were under 40 and 20 (71 per cent) were over 50 Twenty four goiters were nontoxic and nodular three were nodular with a mild degree of hyperactivity and one showed carcinoma. There were no instances of toxic diffuse hyperplasia with exophthalmos The most constant complaints, in order of frequency were swelling of the neck, dyspnea on exertion, cough, dysphagia dyspnea on lying down, choking sensation and hoarseness four patients were asymptomatic. On physical examination, the commonest and most important finding was palpable enlargement of the thyroid, which was present in all patients in whom intrathoracic extension was partial Deviation of the trachea and dilatation of the neck veins were not often noted One patient had a plunging goiter and one vocal cord paralysis. All goiters were located in the superior mediastinum 19 were anterolateral to

(3) Radiology 53 227 237 August, 1949.

the trachea, 6 behind the trachea and 3 behind the esophagus.

The significant roentgen findings were displacement of the trachea by the mass in 27 cases, displacement of the trachea beginning high in the neck, frequently at the larynx and with some tilting of the latter, compression of the trachea, often present but not in severe degree displacement or compression of the esophagus accompanying similar changes in the trachea upward motion of the goiter with swallowing in 84 per cent of the patients examined *calcification within the* goiter in 25 per cent a smooth or only slightly nodular outline of the tumor, reflection of the mediastinal pleura below the goiter

The only satisfactory treatment is surgical removal. This is indicated because 7.2 *per cent of nodular goiters are said* to be malignant, sudden tracheal compression (from hemorrhage into the gland or sudden and rapid growth of the gland) may result in asphyxiation, and interference with venous return from the head may result in syncope. Complete *surgical removal was accomplished without complication in* all cases. There is no indication for deep roentgen therapy of intrathoracic goiter

[There can be no doubt about the wisdom of surgical removal of intrathoracic goiters. There may not be complete agreement about the best approach. The smaller ones can be satisfactorily removed through the usual collar incision. But for the very large ones our preference is to use a sternum-splitting incision.—Ed.]

Tumors of Parathyroid Review of 23 Cases is presented by Boyd K. Black and Lauren V Ackerman[4] (Washington Univ) Most patients were in the fourth decade. The adenomas appeared approximately one decade earlier and about three times more often in men than in women. Hyperparathyroidism should be suspected when there are (1) renal stones without evidence of the usual causes; (2) recurrence of renal stones (3) renal stones in the parenchyma, (4) nephrocalcinosis, (5) multiple bone lesions, (6) a single cystic bone lesion, particularly in the maxilla or mandible (7) multiple spontaneous fractures, and (8) diagnostic problems, especially in patients with nausea and vomiting weakness and anorexia. The adenomas in this series were composed of any one or a combination of chief wasserhelle, oxyphil and transitional cells. Cells may be arranged in strands or sheets

(4) Cancer 3 418-444 May 1950

or show papillary, acinous or perithelial formation. Parathyroid adenomas usually occur singly, but in rare instances two have occurred simultaneously

Kidney and bone lesions are common complications of hyperparathyroidism. In this series three patients had symptoms related to kidney stones alone, three kidney stones and bone changes, one a history of stones and five asymptomatic stones. Renal stones usually persist after removal of a parathyroid tumor The degree of renal damage before removal of the parathyroid adenoma is the most important determining factor in the ultimate prognosis. After removal of the adenoma, every effort, including removal of renal stones, should be made to protect and improve kidney function. Nine of the 12 patients with kidney lesions died, 6 of renal insufficiency

Bone changes were the primary symptom in 17 patients. The lesions ranged from slight, diffuse osteoporosis to multiple bone cysts and fractures. In two patients there were peptic ulcers associated with parathyroid adenoma. In two others there was the rare combination of parathyroid adenoma complicated by long-standing secondary nephrocalcinosis, with profound impairment of kidney function and resultant secondary hyperplasia of the other parathyroid gland.

Although unequivocal carcinoma of the parathyroid is rare, local invasion with definite metastasis to a regional node was discovered in one patient at the first operation. In most instances in the literature, characteristics on which a microscopic diagnosis of parathyroid carcinoma has been based are not valid. Such characteristics include variation in cell morphology invasion of capsule and tumor cells in the lumens of veins Tumors with gross or microscopic characteristics of adenoma, which recur locally after incomplete removal, should not be designated as carcinoma. This term should be reserved for tumors which show unmistakable evidence of invasion at the time of the original operation and for those that metastasize.

Primary hyperplasia and hypertrophy may cause hyperparathyroidism. It is characterized by extreme enlargement of all parathyroid tissue the total weight may exceed 65 Gm. One gland may be much larger than the others, but this is due to the relative size of the glands originally Glands may

coalesce or form pseudopods which may *extend considerable* distances away from the main mass. Microscopically there are extremely large, clear cells. Treatment consists of removal of all except about 200 mg parathyroid tissue, which is left behind so that hypoparathyroidism will not develop

In secondary hyperplasia there is slight to moderate enlargement of all glands, but they are rarely as large as a usual adenoma. Microscopically the cells form compact areas, and the columnar arrangement is no longer distinguishable These glands are composed of normal-sized chief cells or transition wasserhelle cells. Such changes may progress to the formation of an oxyphil adenoma

In this series five glands were found in unusual locations Three were in the anterior mediastinum and two behind the esophagus.

Operation must be as bloodless as possible so that the parathyroids will not be obscured If an atrophic gland is discovered it is presumptive evidence of parathyroid adenoma Normal parathyroids should not be removed and their blood supply should be preserved because of the danger of infarction. Parathyroids are somewhat brown before puberty but with increase in fat content they become yellow Lymph nodes, bits of adenomatous thyroid, small nodules of fat, adenomas of thyroid and portions of thymus may be mistaken for parathyroid adenoma.

Surgical Treatment of Hyperparathyroidism Report of 27 Cases is discussed by William Francis Rienhoff Jr[5] (Baltimore) Of 23 patients in this series with benign tumor or adenoma of the parathyroid gland 2 had two adenomas. One patient had diffuse hypertrophy and hyperplasia of the four glands, and in another there was definite malignant change in the parathyroid gland. This made a total of 27 adenomas (Fig 33) Renal complications outnumbered osseous ones and males were affected more often than females. In each instance in which there was skeletal complication, serum phosphatase level was elevated. The correlation between tumor *size and elevated blood calcium and* between renal complications and elevated blood calcium was not striking There was one postoperative death and one recurrence Seven patients had rather severe postopera

(5) Ann Surg 131 917 944 June, 1950

tive tetany Signs and symptoms disappeared promptly after oral administration of calcium in all but the one patient who died postoperatively

After postoperative periods of 3-11 years there have been 9 deaths among the 25 patients. All were due to hypertension with or without renal insufficiency Since complications

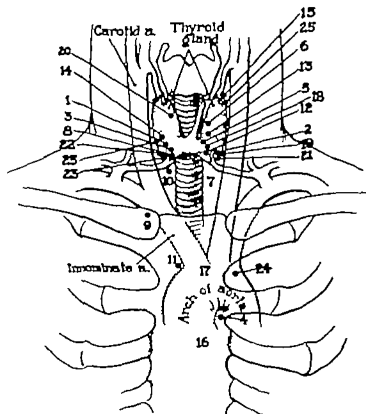


Fig. 33 —Location of adenomas of parathyroid glands in 25 cases of hyperparathyroidism. No. 25 is shown both at the right lower and left upper poles. There was an additional adenoma removed a year later (not shown in diagram) which lay beneath the left lower pole, making a total of 27 adenomas in 25 patients. (Courtesy of Rienhoff W F., Jr Ann. Surg. 131 917-944 June 1950)

were not present in some of these patients at operation, it is apparent that removal of an adenoma, with return of blood calcium, phosphorus and phosphatase levels to normal, does not halt a continuous degenerating process which goes on for several years, resulting in hypertension with or without renal insufficiency Prognosis is best in those with the least renal damage and in whom blood pressure

and blood nonprotein nitrogen, calcium and phosphorus return to normal levels within a reasonable time postoperatively

At least 80 per cent of parathyroid tissue both normal and abnormal, is found in the region of the thyroid gland, the remainder may be displaced either because of embryologic descent of this tissue or mechanical displacement of an enlarged gland. Development of the upper pair of parathyroid glands is simplest. They arise from the fourth branchial cleft, the lateral parathyroid primordia appearing above and behind the lateral thyroid, which arises from the same cleft They descend in this relation to the lateral thyroid body as it descends into the neck to join the median thyroid component. The commonest position of the superior parathyroid gland is about at the junction of the middle and upper thirds of the lobe of the thyroid gland They lie in a plane dorsal to the recurrent laryngeal nerve and inferior thyroid artery The anlage of the inferior parathyroid arises from the third branchial cleft rostral to that of the superior gland and migrates caudally along with the thymus, lateral and ventral to the pathway of the superior parathyroid and thyroid glands (Figs. 34 and 35) They may finally rest anywhere in the region from 1 cm. above the larynx to the diaphragm in the anterior mediastinum. In the adult, inferior parathyroids may be found in the visceral compartments of the cervical fascia or when enlarged, they may be displaced caudally through the superior strait of the thorax due to gravity or intrathoracic suction (Figs. 36 and 37) No parathyroid glands were found on the anterior surface of the thyroid but in two instances they were in the thyroid.

At operation a systematic search must be made of the cervical region and secondarily of the mediastinum.

PROCEDURE.—Pentothal® sodium and curare, supplemented with oxygen administered through an intratracheal tube, provides satisfactory anesthesia. The thyroid is exposed as usual. Examination is first made of the right lobe of the thyroid to note whether it contains intrathyroid nodules. The right lobe is then mobilized and rotated medially exposing first the right lower pole, inferior recurrent laryngeal nerve, inferior thyroid artery and inferior thyroid veins. In this series most parathyroid adenomas were found near these vessels, either on the right or left side. If no adenomas are found on

the lower poles, dissection is carried upward to the upper pole. All normal parathyroid glands should be carefully preserved, for nothing can be gained by their removal. Methodical search is made

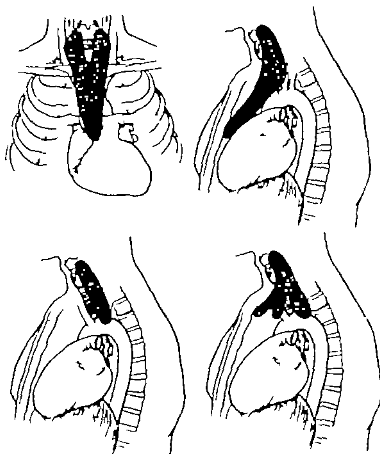


Fig. 34 (top left).—Anterior view of embryologic pathways of adult inferior parathyroid gland rising from third branchial cleft. Inferior parathyroid gland or adenoma rising from it may be discovered at any point along this pathway from 1 cm. or more above superior pole of thyroid down as far in the anterior mediastinum as the descent of thymus and lateral from the carotid sheath to midline.

Fig. 35 (top right).—Lateral view of embryologic pathways of adult inferior parathyroid gland rising from third branchial cleft.

Fig. 36 (bottom left).—Possible pathway of mechanically dislocated adenoma rising in superior parathyroid gland, from 1 2 cm. above the superior pole of the thyroid gland drawn into the superior posterior mediastinum.

Fig. 37 (bottom right).—Path of dislocation of adenoma of inferior parathyroid gland which may be aspirated into posterior or anterior superior mediastinum, depending on original position of parathyroid gland before enlargement due to development of an adenoma.

(Courtesy of Rienhoff, W. F., J. Am. Surg. 131:917-944 June, 1950.)

in the region of the right upper pole and posterolateral surface of the thyroid gland, region of pharynx and larynx, carotid sheath, retroesophageal region between the esophagus and prevertebral fas-

cia, region between the trachea and esophagus, and posterior superior mediastinum. If the adenoma has not yet been found, the same procedure is carried out on the left side. The posterior superior mediastinum is then dissected under direct vision through the cervical approach. Thymic cervical rests should be investigated for adenomas, but if none are found the thymus should be left in situ, if it is resected, normal parathyroid glands may be removed in the process. If careful dissection of the neck and superior posterior mediastinum is fruitless, the sternum is split and the anterior superior mediastinum dissected under direct vision. Adenomas may weigh 0.4-120 Gm. and are darker brown than the normal adult parathyroid gland.

If bony changes are predominant and there is a high blood phosphatase level, a portion of the adenoma should be transplanted into the thyroid or the belly of the sternocleidomastoid muscle to prevent calcium hungry bones from draining calcium ions from the blood stream and tissues to such an extent that critical postoperative tetany is produced.

When there is diffuse hypertrophy and hyperplasia of all glands, partial resection should be performed, leaving 30-200 mg hyperplastic tissue. Care should be taken to guard the blood supply of the remnant left behind.

BREAST

Role of Pathology in Lesions of Breast. Arthur Purdy Stout[6] (Columbia Univ.) states that a thorough understanding of breast disease pathology is essential for diagnosis and proper application of treatment.

Gynecomastia is almost always symmetrical and consists of an increase of ducts and stroma if it occurs spontaneously it is never associated with cancer If it is a smooth uniform enlargement, its removal in elderly men for fear of malignancy is unnecessary However if it is induced by administration of diethylstilbestrol in treatment of metastatic prostatic cancer it may lead to unilateral or even bilateral breast carcinoma.

Contrary to common belief, bleeding from the nipple is one of the rarest of early signs of female breast cancer but is the classic sign of intraductal papillary tumors. It

(6) South. M. J. 43 205 212 March, 1950.

might be expected in Paget's disease but, to Stout's knowledge, does not occur

There is no evidence to substantiate the impression that intraductal papillary tumors of the breast are precancerous growths any more than is the case with any duct epithelial cells. In no case of intraductal tumor locally removed at Presbyterian Hospital and followed 5 15 years has cancer developed in either breast.

There is no general agreement on the exact nature and probable behavior of cystosarcoma phyllodes. Seven cases were treated by radical mastectomy, five by simple mastectomy and three by local excision. In no case was there involvement of the axillary lymph nodes, and no recurrence has been observed in eight patients who were followed for 5-19 years. It seems to be a relatively harmless tumor for which radical mastectomy is unnecessary partial or complete mastectomy depending on its size is sufficient.

Breast carcinoma sometimes grows without formation of scar tissue, forms a rounded ball does not produce any of the classic signs of cancer and cannot be surely distinguished from a cyst or localized area of fibroadenomatosis or cystic disease If diagnosis cannot be made by quick frozen section it is best to close the biopsy wound and wait for the paraffin section.

Carcinoma does not spread only by direct invasion through the breast tissues. It also enters the lymphatics and causes axillary lymph node metastasis which reduces the chances of cure by about 40 per cent. It may also spread in the breast via the ducts and in a few cases remains restricted to them for a considerable time Such tumors are called intraductal or comedone tumors and are slower to metastasize than the infiltrating variety A rare variant is the epidermophile which combines with an inflammatory reaction to produce Paget's disease of the nipple Breast cancer may spread also by direct invasion of veins and capillaries

Prognosis in circumscribed and intraductal carcinomas and probably also in Paget's disease and colloid carcinomas is more favorable than in the more malignant diffuse small cell carcinomas

Treatment and Results in Cancer of Breast at Presbyterian Hospital, New York City, are presented by C D Haagensen.[7] In this institution two factors have led to more radical surgery and away from irradiation. The Halsted type of surgery, which includes meticulous dissection with exact hemostasis and gentle handling of tissues, using silk technic, has made it possible to carry out more thorough dissections with removal of more tissue As much tissue is removed from the chest wall and axilla as possible without unreasonable danger to the patient's life or arm function. So much skin is sacrificed that a skin graft is almost always required to cover the remaining defect. Skin flaps are cut thinner than in the usual radical mastectomy and both pectoral muscles are removed entirely Despite such radical surgery there is no added morbidity or mortality because of proper attention to technical details. A second factor which has led to the sole reliance on surgery is that in an experimental series of cases intensive x ray treatment failed to destroy cancer of the breast. However x ray treatment is regarded of inestimable value for palliation.

In selecting cases for surgery the criteria of Haagensen and Stout are recommended. Women of all age groups who are in good enough general condition to run the risk of major surgery should be treated by radical mastectomy except when (1) carcinoma has developed during pregnancy or lactation (2) extensive edema of the skin over the breast is present (3) satellite nodules are present in the skin over the breast (4) intercostal or parasternal tumor nodules are present (5) there is edema of the arm (6) proved supraclavicular metastases are demonstrated, (7) carcinoma is of the inflammatory type (8) distant metastases are demonstrated, and (9) any two or more of the following signs of locally advanced carcinoma are present—ulceration of the skin, edema of the skin of limited extent, solid fixation of the tumor to the chest wall, axillary lymph nodes measuring 2.5 cm. or more in transverse diameter and proved to contain metastases by biopsy and fixation of axillary lymph nodes of the skin or deep structures of the axilla.

Radical mastectomy was performed in 495 of 668 primary

(7) Am. J Roentgenol. 62 325-334 September 1949

cases of breast carcinoma between 1935 and 1942 The absolute five year survival rate was 47.2 per cent and the absolute five year cure rate 38.6 per cent. Local recurrence developed in 14.5 per cent. The relative five year survival rate was 58.2 per cent and the relative five year cure rate

TABLE 1.—Results of Radical Mastectomy According to Length of Operation

Length of Operation Min.	Cases	Operative Deaths		5 Yr. Local Recurrence		5 Yr. Clinical Cure	
		No.	%	No.	%	No.	%
1-59	0						
60-119	17	1	5.9	4	23.5	4	23.5
120-179	74	2	2.7	11	14.9	33	44.6
180-239	145	2	1.4	21	14.5	67	46.2
240 or more	259	4	1.5	36	13.9	137	52.9

TABLE 2.—Results of Radical Mastectomy According to Five Year Periods

Period	Cases	Operative Deaths		5 Yr. Local Recurrence		5 Yr. Clinical Cure	
		No.	%	No.	%	No.	%
1915-19	128	3	2.3	32	25.0	34	26.6
1920-24	127	7	5.5	24	18.9	37	29.1
1925-29	160	8	5.0	42	26.3	53	33.1
1930-34	225	2	0.9	48	21.3	107	47.6
1935-39	314	5	1.6	52	16.6	146	46.5
1940-41, 42	181	4	2.2	20	11.0	95	52.5

48.7 per cent. In 94.9 per cent of the cases the disease was operable according to the criteria given. In these the five year cure rate was 71.8 per cent when the axillary nodes were not involved but only 37.8 per cent when axillary metastases were present. In 25 cases in which the disease was inoperable according to these criteria, yet radical mastectomy was done only one patient survived as long as five years and the local recurrence rate was 40 per cent.

Table 1 presents data which illustrate the advantage of a thorough operation, in that the cure rate rose and the frequency of local recurrence fell as the length of time devoted to operation increased. Improvement in results of treatment at Presbyterian Hospital during the last genera

tion seems to have occurred without use of x ray therapy, for this procedure has been used infrequently during recent years (Table 2) A more critical selection of patients for operation is probably the main factor

Treatment and Results in Cancer of Breast. Grantley Walder Taylor[8] presents a summary of results in cases seen at Massachusetts General Hospital since 1894 (table) Patients selected for radical mastectomy since 1936 have been chosen according to the criteria of Haagensen and Stout In general, a standard radical operation has been

SUMMARY OF DATA IN CASES SEEN SINCE 1894

	1894 to 1904	1911 to 1914	1918 to 1920	1921 to 1923	1924 to 1926	1927 to 1929	1930 to 1932	1933 to 1935	1936 to 1940
Total primary cases	468	103	134	183	208	220	231	328	
Radical operations	360	74	100	148	158	180	185	236	395
Operability %	77	72	75	80	74	80	80	72	
Died without recurrence in less than 5 yr				6	11	10	11	14	11
Axilla free, %	33	31	30	28	41	36	37	40	41
Cures in 1 A cases, %		56	54	62	64	74	70	75	78
Cures in 1 C cases %		24	23	21	26	24	31	33	34
Cures in all operations, %	19	27	30	35	41	43	45	50	52

performed. Skin removal is less extensive than that practiced in some places, and skin grafting is necessary in less than 10 per cent of cases

Presence or absence of axillary lymph node involvement is the most significant factor in determining prognosis postoperatively When disease is limited to the breast chance of cure is about 75 per cent, but when there is axillary involvement it is about 33 per cent. When only one or two nodes contain metastases, prognosis is nearly as favorable as when there is no metastases, but results become progressively worse with more extensive involvement. The grade of malignancy is of great significance in prognosis. Lesions of high grade malignancy have a poorer prognosis than those of low grade Age is another significant prognostic factor in that young women have a greater proportion of carcinomas of high grade malignancy with earlier involvement of axillary lymph nodes Duration of the pri

(8) Am. J Roentgenol 62 341-344 September 1949

mary tumor is of great significance in the individual case Small tumors have a much more favorable prognosis than large tumors. A poor prognosis can be given in cases with skin involvement and ulceration.

In this series it was not possible to establish that prophylactic x ray treatment has improved results of operation or decreased or deterred appearance of operative field re currences. Castration, either surgical or by x rays, has not increased the curability in this series It is only used in treatment of inoperable and recurrent cancers in young women. The most striking favorable results are observed in patients with skeletal metastases. In elderly patients with inoperable and recurrent carcinomas, estrogenic hormones may cause regressions of local and lymph node disease and of pulmonary metastases Androgenic hormones appear to be beneficial primarily in patients with skeletal metastases.

Cancer of Breast H. Glenn Bell[9] analyzed 819 cases seen at University of California Medical Center from July 1 1930 to Jan. 1, 1944 in 83 no treatment was given at the Center but the patients were followed in 736 some form of definitive or palliative treatment was given. Of the whole series of patients, 264 (32.2 per cent) were well five or more years after treatment. There were four operative deaths (0.85 per cent) in 470 primary surgical cases.

Schenck's classification was used. The five year survival rate was 61.8 per cent for 173 patients in stage I, 39 8 per cent for 201 in stage II and 8.3 per cent for 203 in stage III In these three groups, which include all patients with pri mary carcinoma there were 105 who were given roentgen therapy alone, which in most instances was palliative Of the 470 patients in whom a definite attempt at cure was made by surgery with or without radiation, 201 lived five years without recurrence Thus, the five year survival for those with operable lesions was 42.8 per cent. In stage IV 24 (22 6 per cent) of 106 patients who had a recurrence of a carcinoma that had been operated on elsewhere were well five or more years after treatment. In stage V 53 (39 per cent) of the group who had surgery elsewhere followed by roentgen therapy at University of California Hospital were well over five years. In stage VI 15 (18 per cent) of the

(9) Am Surg 130 310 317 September 1949

83 patients who were simply followed after treatment elsewhere lived five years without recurrence

Statistically, the possible benefits of roentgen therapy are not reflected in the five year survival rate In stage I the highest five year survival was in patients who had radical surgery only In stage II the slightly higher survival rate with preoperative roentgen therapy is probably not significant In stage III use of radiation resulted in a *somewhat larger percentage of five year survivals of 14* patients who had simple mastectomy plus postoperative irradiation 21 4 per cent were well five years later as compared with 16 6 per cent of patients who had radical surgery alone. In the entire group use of pre or postoperative roentgen therapy did not increase the number of five year survivals The 10 year survival rate for stage I and stage II regardless of treatment is 41 8 per cent.

Marked swelling of the arm occurred in 11 (3 4 per cent) of the surgically treated patients and in 13 (5 8 per cent) of those treated with surgery supplemented by roentgen therapy in none was the swelling incapacitating

Treatment and Results in Cancer of Breast Stanford Cade[1] (London) has adopted U V Portmann's classification as a guide for treatment of breast cancer *Stage I is characterized by* tumor of the breast only stage II, by tumor

Per Cent of 5 and 10 Year Survivals in 263 Cases (1932-38) on Basis of Treatment

Stage	Surgery		Radium		Surgery + Radium	
	5 Y	10 Yr	5 Y	10 Y	5 Yr	10 Yr
I	87	65	70	60	78	63
II	29	25	25	21	35	32
III	9	7	15	13	10	9

plus skin changes and/or axillary lymph nodes stage III, by tumor plus supraclavicular lymph nodes, contralateral axillary lymph nodes or fixation to pectoral fascia stage IV by skeletal or visceral metastasis.

The only adequate surgical treatment for breast cancer is radical mastectomy Successful radiotherapy may be given with either radium or x rays, the only advantage of

(1) Am. J Roentgenol 62 326-327 September 1949

radium being the greater tissue dosage achieved. Since adequate radiotherapy leads to clinical regression of the tumor it is obvious that preoperative irradiation is of greater value than postoperative There is statistical evidence that preoperative irradiation gives improved long term results.

Choice of treatment can be summarized as follows stage I, radical surgery, stage II, preoperative radiotherapy and radical surgery, stage III, radiotherapy only Surgery in stage III is not warranted and often leads to more rapid progress of the disease than if no treatment were given. Survival data on 263 cases, divided according to method of treatment, are shown in the table

Treatment and Results in Cancer of Breast Elis Berven[2] (Univ of Stockholm) reviews results in 3 623 patients observed during 1921-41. Cancer was too advanced for treatment in 740 Palliative treatment was given to 544 whose condition was inoperable on admission, and different types of radiation were administered to 535 who had recurrences after operation elsewhere Criteria of inoperability were fixation of the tumor to the thoracic wall or evidence of massive and fixed metastases to the axillary lymph nodes, supraclavicular fossa or distant organs.

Between 1921 and 1935 1,035 patients were treated by radiation and surgery with a five year cure rate of 42 per cent and survival rate of 46 per cent. Between 1936 and 1941, 796 patients were similarly treated, with a five year cure rate of 43 per cent and survival rate of 51 per cent. During the two periods, about 40 per cent of the operable patients had stage I (Steinthal) and 60 per cent stage II lesions (Steinthal) This proportion between the two stages has not improved in the past 21 years despite increasing efforts to educate the public to seek medical advice as early as possible

Between 1936 and 1941, 203 patients with stage I cancers received pre and postoperative irradiation and 95 received postoperative roentgen treatment only, but the five year survival rate was 66 per cent in each group In the same period 354 patients with stage II cancers received pre- and postoperative x ray treatment and showed a five year sur

(2) Am. J. Roentgenol. 62 320-335 September 1949

that the value of x ray therapy has certainly not yet been established in any but the inoperable cases.—*Ed.*]

Internal Mammary Lymph Chain in Carcinoma of Breast. R. S Handley and A. C Thackray[4] explored the anterior mediastinum through the second or third intercostal space in 50 consecutive cases and found that the internal mammary chain was invaded in 19 in 16 the deposits were in lymphatic glandular tissue, in 2 in the connective tissue adjoining the internal mammary artery, and in 1 within the lumen of a mediastinal venule, in 3 of the 19 the internal mammary chain alone was invaded and in 16 both axillary and internal mammary glands were involved. The axilla alone was invaded in 15 No glandular deposits were found anywhere in 16 Of the 13 primary growths in the inner half of the breast which showed glandular deposits, 12 had metastasized to the internal mammary chain and only 1 had invaded the axillary glands alone. To expose the internal mammary chain is easy, but to find the lymph nodes is difficult because they are often exceedingly small.

TECHNIC.—The chest wall having been exposed over the second or third intercostal space, an incision 1¼ in long is made in the intercostal musculature, parallel to the costal cartilages and midway between them and extending medially to the edge of the sternum. The fibers are cautiously divided until the mediastinal fat appears or the lung is seen through the pleura to be sliding to and fro Dissection then proceeds with two fine nontoothed forceps and gauze. The internal mammary vessels lying about ½ in. lateral to the edge of the sternum are picked clean. A lymph node is often encountered in the superomedial angle of the space. All tissue removed deep to the internal intercostal muscle should be sectioned and will generally show unsuspected aggregations of lymphoid follicles. A tear in the pleura, if recognized, is of no consequence when the anesthetist has been forewarned of the possibility The intercostal space cannot be closed after the exploration, since the intercostal muscles will not hold sutures.

Exploration of the second intercostal space is not to be regarded as a method of treatment for carcinomatous deposits in the internal mammary chain, but as a reconnaissance designed to give fuller information about the movements of the carcinoma cells. The only method of dealing with these deposits so far reported is implantation of radium tubes in the medial end of the intercostal spaces, and its efficacy has not yet been unequivocally proved.

(4) Lancet 2 276-278 Aug. 13 1949

Categorically Inoperable Carcinoma of Breast. William L. Tomlinson and Clarence T Eckert[5] (St. Louis) applied the criteria of inoperability, established by Haagensen and Stout at Presbyterian Hospital, New York City to all cases of breast carcinoma seen at Barnard Free Skin and Cancer Hospital between 1933 and 1943 Of these, 167 fell into the categorically inoperable group in 100 routine radical mastectomy or some similar radical operation had been done, and in the other 67 only roentgen therapy had been used. Of the surgical patients, only 2 were well and clinically free from carcinoma at the end of 5 years 1 for 8 and the other for 14 years Both had carcinoma associated with pregnancy or lactation there were only three such patients in this series.

The question of whether a category of inoperability, in technically operable cases, is justifiable is of great importance The fact that there were only two possible cures in the present series indicates the poor results which can be expected in cases in this category Strangely enough, both survivals were in cases associated with pregnancy Harrington reports more encouraging results in the treatment of breast cancer in the course of pregnancy and lactation. Haagensen also recently pointed out that radical mastectomy may be justified in these cases, if the disease is locally operable

The 36 3 months average survival for surgically treated patients in the present series is quite close to that of 32.3 months for a surgically treated group from Presbyterian Hospital, now considered inoperable by the Haagensen-Stout criteria. The Barnard group treated by roentgen rays alone had an average survival of 34.2 months which is somewhat shorter than that (42.3 months) *for the group from Presbyterian* Hospital who were regarded as inoperable and were not treated by surgery and radiation.

Thus, it appears that as a rule patients with mammary cancer who fall into the Haagensen-Stout category of inoperability will not profit by radical surgery At this time, patients whose cancers occur during pregnancy or lactation may be an exception. It is also possible that other criteria of inoperability may be proved to be questionable

(5) Ann. Surg. 130 38-42 July 1949

However only by classifying cases against definite standards of involvement will it be possible to arrive ultimately at certain standards for the most beneficial treatment.

Implications of Local Excision or Simple Mastectomy Prior to Radical Mastectomy for Carcinoma of Breast. Charles E Lockhart and Lauren V Ackerman[6] (Washington Univ) studied 41 patients with proved carcinoma of the breast who had had simple mastectomy or local excision of the tumor for diagnostic purposes. Twenty two had radical mastectomies after admission and 19 were considered inoperable on admission. Of the entire group only nine patients are living without disease in all these the interval between the primary procedures and radical mastectomy was two months or less Only five of the inoperable group were admitted within two months after surgery Such findings emphasize the importance of a short interval between the initial biopsy and radical treatment.

Among the 19 patients originally treated by simple mastectomy it was feasible to do radical mastectomy in only 6, and only 2 of these are living without disease. The radical operation was not performed in the others because they were considered inoperable at hospitalization. Probably patients with obvious local recurrence or regional lymph node metastases after simple mastectomy should not be subjected to radical mastectomy, but they might benefit more from palliative irradiation. Among 22 patients initially treated by local excision, radical mastectomy was justified in 16 and 7 are living without disease.

In the patients who had radical mastectomy clinical examination proved inaccurate for detecting the presence of persistent tumor or axillary involvement. Histologic examination disclosed that errors were made in 12 of the 22 cases In three of the successfully treated patients persistent tumor was found in the histologic specimen at the site of previous excision.

When a patient has a single lump in the breast the tumor should be exposed in the operating room, and if there is any doubt as to its nature a frozen section should be made When the suspected single nodule is small (2 or 3 cm.) it may be removed completely with a margin of healthy sur

(6) Surgery 26 377 383 October 1949

rounding breast tissue In the case of larger lesions total excision is not practicable and incisional biopsies should be performed Under no circumstance should aspiration biopsy or simple mastectomy be used as diagnostic procedures.

Results in this series showed that once simple mastectomy has been done for cancer the prognosis is extremely poor in practically every instance When radical mastectomy is performed for cancer after simple mastectomy a far more extensive and difficult operation is required The area previously undermined in the raising of flaps for the first operation must be removed widely leaving a tremendous defect on the chest wall which necessitates use of a skin graft. Local recurrences are common after simple mastectomy because the amount of skin sacrificed is small and relatively thick skin and subcutaneous tissue flaps are usually dissected, an incision often being made across strands of tumor which reach toward the skin surface, these flaps are subsequently plastered down against denuded pectoral fascia providing an excellent bed for growth of residual tumor Simple mastectomy is also performed too often for large tumors which cannot be encompassed by local excision. From a diagnostic viewpoint simple mastectomy rarely provides more information than can be gained by simple biopsy of the tumor mass Biopsies of breast tumors should be made with facilities for subsequent radical mastectomy immediately available, not only because most patients prefer to be treated completely at one time but because many human factors may intervene after biopsy and cause delay which may be disastrous.

Postmastectomy Swelling of Arm With a Note on Effect of Segmental Resection of Axillary Vein at the Time of Radical Mastectomy Allan W Lobb and Henry N Harkins[7] (Univ of Washington) report that 41 of 61 patients on whom unilateral radical mastectomy was performed showed an average arm swelling of 2.5 cm. on the side operated on. The swelling was 3 cm. or more in 22 per cent the greatest amount recorded was 10 5 cm

Analysis based on age suggested that the decreased tissue turgor of older persons may cause a tendency toward

(7) West. J Surg 57 550-557 November 1949

fluid accumulation. The predominant influences on arm swelling after mastectomy appeared to be x ray treatment, skin recurrence and impaired arm function. Arm swelling did not seem related to skin grafting axillary metastasis, wound infection or operation on the side of dominant handedness

A 4-8 cm. segment of axillary vein was excised and the cephalic vein preserved in four cases In three there was no swelling and in the other there was swelling of the forearm but only slight swelling of the upper arm. This procedure may be performed to remove adherent carcinomatous lymph nodes with the expectation of little significant postoperative swelling

Incidence of Swollen Arms after Radical Mastectomy and Suggestions for Prevention. Ernest M. Daland[8] (Pondville Hosp., Walpole, Mass.) examined 90 patients after radical mastectomy for cancer 1 was later found not to have had the disease All were apparently free from disease at examination

In five patients the circumference of the upper arm on the side operated on was less than that on the normal side this also applied to the forearm of six patients. Since these patients had normal function and no evidence of muscle atrophy, this finding is best explained by the normal variation between the two arms and the inaccuracy of the measurements.

No difference in measurements of the two arms was noted in 13 patients, 21 had no swelling of the upper arm and 31 none of the forearm an increase of 0.5 cm. in circumference considered within normal limits, was noted in 15 upper arms and 13 forearms. Thus, 41 patients (45 per cent) had no swelling of the upper arm and 50 (55 per cent) had none of the forearm

Anything over 0.5 cm. increase in circumference was regarded as swelling and increases of 1 2.5 cm. were considered as slight swelling There were 28 upper arms and 25 forearms in this category (31 and 27 per cent, respectively) None of these had brawny lymphedema and most of the upper arm swellings were soft because of relaxation from the axillary dissection All these patients had normal use

(8) New England J Med. 242 497 501, Mar 30 1950

of their arms, and many were unaware that they had any swelling

Moderate swelling applied to increases of 2.5-4.5 cm. In this group there were 16 upper arms and 9 forearms (17 and 10 per cent, respectively) In only one case was there slight limitation of motion. In some cases the edema was firm and seemed to be of the lymphatic type.

Severe swelling of the upper arm was present in five patients (5 5 per cent) and of the forearm in six (6 6 per cent) Many of these had severe disability from the weight of the arm, although all but two had normal range of motion.

The Greenough modification of the Rodman incision (Figs. 38 and 39) was used in all patients It consists of a trans-



Fig. 38 (left).—Arrowhead-shaped incision for radical mastectomy
Fig. 39 (right).—Closure of incision, leaving no scar on arm.
(Courtesy of Deland, E. M.: New England J Med. 242 497 502, Mar. 30 1950.)

verse axillary incision with an arrowhead-shaped incision about the breast. A segment of skin between the breast and the axilla is removed. The axillary dissection is completed before the breast is removed. When the incision is closed, there is no scar on the arm. Cotton ligatures are used. All wounds are drained for three to five days Moderate pressure is applied to a large dressing Early use of the arm is the rule, but the patient is told not to do exercises

Preoperative roentgen treatment has not been used in Pondville Hospital in recent years, and postoperative roentgen treatment is given only when pathologic condition persists after operation. Prophylactic treatment was given to 13 patients, 9 of whom had enlargement of the upper arm of 2.5-15 cm. and 6 enlargement of the forearm of 2.5-11 cm. The patients with the greatest amount of swelling were those who received the highest doses of x rays

Accumulation of serum in the wound must be avoided because it causes fibrosis. If roentgen therapy is given, care must be taken to avoid a cicatricial band of scar through the axilla, for it will produce swelling

Treatment of Advanced Mammary Cancer with Estrogens. Max Cutler Melvin Schlemenson, John J Kearney (Chicago) and Eduardo Caceres[9] (Lima, Peru) treated 20 patients with large doses of both synthetic and natural estrogenic substances including diethylstilbestrol monomethyl ether diethylstilbestrol and a solution of estrogens in oil, principally estrone No essential difference in response was noted and vaginal smears demonstrated the follicular phase of the menstrual cycle in all.

In 13 patients the disease progressed and the patients were not benefited. In four of these there were metastases to bone In three patients the general condition was decidedly improved and the disease temporarily arrested. In four ulcers of the breast healed and treatment was believed beneficial. In one of the seven patients in whom there was definite improvement metastasis to a lumbar vertebra showed deposition of calcium Correlation of age with response to estrogens indicated that palliation can be expected most frequently in patients over age 60 Since the patients have not been observed long enough the exact duration of palliation cannot be discussed. Certain patients with advanced cancer of the breast experience relief from pain and a sense of well being during estrogen therapy even when there is no objective improvement.

Though there was no evidence that the disease was accelerated in any case other observers have suggested that this may occur in young women Cautious treatment is advised for that group

(9) Surgery 26 507 572 October 1949

LUNG

General

Diagnostic and Prognostic Value of Pulmonary Function Tests Julius H. Comroe Jr., and William S Blakemore[1] (Univ of Pennsylvania) describe six types of pulmonary function tests which are of value to the thoracic surgeon

METHODS.—1. Static lung volumes measure maximal air inspired at the resting expiratory level (inspiratory reserve normally 3,500 cc.) and maximal air expired (expiratory reserve normally 1 000 cc.) Vital capacity (sum of inspiratory and expiratory reserves) is measured with ordinary basal metabolism apparatus. The air remaining after maximal expiration (residual capacity normally 1,500 cc.) is measured indirectly by calculating the nitrogen in the expired air of a patient breathing 100 per cent oxygen for seven minutes (method of Darling, *et al*) A change of 100 cc. in repeated serial measurements is significant if the patient is co-operative.

2. Dynamic lung volumes measure the rate, depth and minute volume of breathing Maximal breathing capacity is measured by requiring the patient to breathe as deeply and as rapidly as he can for 15 seconds. When maximal breathing capacity is greatly reduced in a co-operative patient with a normal vital capacity respiratory obstruction or decreased lung elasticity is suspected. An increase in the ratio above 1 1.3 of the inspiratory and expiratory time during quiet breathing suggests mechanical difficulties in expiration. The breathing reserve is the difference between maximal breathing capacity and minute volume and correlates with the degree of dyspnea.

3 Intrapulmonary gas mixing is measured by breathing oxygen for seven minutes. If nitrogen content of the terminal maximal expiration is more than 2.5 per cent, poor mixing is assumed. This is often observed in patients with obstruction (asthma, etc.) or emphysema.

4. The diffusion rate of oxygen across the alveolar capillary membrane is not accurately measured quantitatively with uneven mixing Krogh's quantitative method involves inhalation of carbon monoxide in low concentrations. Semiquantitative methods involve measurement of arterial oxygen saturation before and during exercise. Another method (oximeter test) involves charting the arterial oxygen saturation from 97.5 to 100 per cent as the resting patient is given 100 per cent oxygen. The procedure takes longer with a diffusion barrier

5. Pulmonary blood flow arterial pressure and even capillary pressure can be measured with the vascular catheterization technic,

(1) S. Clin North America 29 1671 1691 December 1949

but measurements are infrequently made. They reveal an inade
of the pulmonary vascular bed which may indicate right ventr
failure after lobectomy or pneumonectomy

6. Arterial blood oxygen and carbon dioxide studies serve as
all function tests. Oximeters do not give as accurate quanti
values as chemical determinations. Venous blood oxygen doe
indicate arterial oxygen saturation. Arterial oxygen may be l
the absence of lung disease (as in right to-left shunt) and n
with serious lung disease. Increased arterial carbon dioxide m
present in either alkalosis or acidosis. Blood pH studies are
fore valuable. Patients with serious pulmonary disease may
high, low or normal arterial carbon dioxide content, but, if it is
preoperatively, as little functioning lung tissue as possible a
be removed to maintain compensatory hyperventilation.

Two cases follow which illustrate the use of pulmo
function tests

CASE 1.—Man 67, under treatment for tuberculosis for six y
was admitted because of a possible neoplastic complication. A
x ray one month before had revealed increased infiltration h
upper third of the left lung and a needle biopsy locally revea
primary squamous carcinoma. Pulmonary function studies sugg
a clinical diagnosis of pulmonary emphysema because of a high
sidual capacity decreased inspiratory reserve, normal total ca
ity, poor mixing, anoxemia and respiratory acidosis. Although
patient was a poor operative risk, left pneumonectomy was d
Postoperatively, he had severe dyspnea and died suddenly 24
later At autopsy emphysema and edema of the remaining lung
found.

CASE 2.—Woman, 42, had a history typical of pulmonary hen
gioma, including nosebleeds, multiple telangiectasias of skin
mucous membranes, hemoptysis, cyanosis and a familial his
which included some or all of these complaints. Radiologic stu
revealed two shadows at the left border of the heart. Cardiac s
ies were negative. A diagnosis of disease of the pulmonary pa
chyma was excluded by pulmonary function tests which reveal
low arterial oxygen saturation and normal lung volume. A phy
logic diagnosis of right to-left shunt was therefore made.

[Tests of pulmonary function are of very great value in some cases,
they may serve as a deciding factor in a question of whether or not to
form an extensive resection. In the future they will be used even n
than now—Ed.]

**Experimental Observations on Embolism of Pulmon
Lobar Arteries** in dogs are reported by Masauki Hara a
John R. Smith[2] *(Washington Univ)* who used small inf
able balloons, dried pea seeds, navy beans threaded togeth
glass beads, poppy seeds and a spreading instrument

(2) J Thoracic Surg. 18:536-542, August, 1949

obstruct, distend or irritate the vessels Distention or occlusion of the main pulmonary or lobar arteries did not provoke recognizable reflex or significant mechanical alterations of cardiovascular dynamics Occlusion of twigs of the pulmonary lobar arterial system to about 0.5 mm. diameter produced no significant effects on cardiovascular mechanisms if the embolization was confined to one lobe and widespread mechanical block thus avoided. Nor did mechanical irritation of the lobar vessels and their extreme distention without occluding them have any immediate effect on the circulatory mechanisms.

It therefore seems unlikely that sudden death or immediate distortion of cardiovascular function would follow emboli to the larger lobar vessel systems unless critical mechanical obstruction is established. However in experimental animals death has occurred several hours after a large pulmonary embolism has been sustained, the mechanism of death is not clear Megibow, Katz and Steinetz suggested that thrombi generated by large emboli may be propagated or disseminated to other parts of the lung arterial system. The evidence advanced by Haynes and associates suggesting that capillary or precapillary embolization may cause violent acute reflex cardiodynamic effects raises the possibility that, after obstruction of large arteries, the finest vessels become occluded, possibly by miliary fragmentation of thrombi originating from such major pulmonary emboli

Surgical Management of Respiratory Emergencies during First Few Weeks of Life Leon J Leahy and Winfield L. Butsch[3] (Children s Hosp., Buffalo) describe three cases in which radical surgery was necessary when dyspnea and cyanosis noted at birth failed to improve

CASE 1.—In a boy aged 11 weeks, onset of breathing was slow after an extremely difficult delivery and mechanical resuscitation was necessary Because of temperature of 101 F penicillin was given. When he left the hospital he breathed with difficulty and retracted both ribs and abdomen with each respiratory effort. At age 6 weeks a wheeze developed which became progressively worse After episodes of respiratory distress he was readmitted. A chest x ray was suggestive of emphysema in the left upper lobe. At bronchoscopy the orifice of the left upper lobe bronchus could not

(3) Arch. Surg. 59 466-483 September 1949

be seen because of a slight bulge in this area, suggesting that mucosa was everted at the opening Thoracotomy, at age 14 weeks, showed the left upper lobe definitely emphysematous. The lobe was resected using the individual ligation technic. Recovery was uneventful, and symptoms were completely relieved.

The etiologic factor was not determined Sections from the resected lobe showed alveolar emphysema with some blebs of considerable size Dissection of the gross specimen and microscopic study failed to show any obstructive lesion. There was no evidence of pneumonia The significance of the respiratory difficulties at birth and the evidence of pulmonary infection is unknown Although evidence of bronchial obstruction was not positive, the bronchoscopic findings were highly suggestive

Case 2.—Boy, delivered normally at term, shortly after birth had rapid, labored respirations and cyanosis. A chest x ray showed atelectasis of the right upper and lower lobes and emphysema of the middle lobe. Bronchoscopy showed a swollen membrane and thick mucus occluding the right main bronchus. After the mucus was removed and the bronchus dilated, breathing improved. The upper lobe expanded, the middle lobe became less emphysematous, but the lower lobe remained atelectatic. The child was readmitted three weeks later for cyanosis and labored breathing X ray diagnosis was pleural effusion on the right side with mediastinal shift. During the next two weeks six thoracenteses were performed and varying amounts of fluid removed. An x ray after one of these procedures disclosed a cystlike pocket with a fluid level. Thoracotomy was done at age 7 weeks and a gastrogenic cyst removed. Recovery was uneventful, and symptoms were completely relieved.

With the increasing frequency of thoracic exploration, intrathoracic cysts of gastric origin are being encountered more commonly The chief symptoms are those of pressure in the mediastinum. Cough, cyanosis, dyspnea and regurgitation of food result If there is pressure on the bronchus the course may be similar to that in Case 2 If the child lives long enough, recurrent pneumonia and bronchiectasis develop Hematemesis has resulted from pressure on the esophagus. Peptic ulceration of the gastric cyst with penetration into the lung is rare Aspiration of the cyst may lead to infection and should be avoided if diagnosis can be made otherwise Immediate excision of the cyst is the safest course

Case 3 also emphasizes the futility of conservative efforts to overcome dyspnea and cyanosis when the underlying condition is congenital cystic disease of the lung

CASE 3—Boy was delivered normally at term Breathing has never been normal since birth. The child cried in gasps and turned blue when crying hard. Oxygen was given on several occasions for dyspnea. A chest x ray showed pronounced emphysema of the entire left lung with bleb formation, particularly at the base Operation revealed numerous cysts in the lung particularly the upper lobe, which was completely replaced by large cysts. Pneumonectomy was performed at age 7 weeks. The child was discharged without any breathing difficulty

The pulmonary cyst which causes a serious degree of respiratory distress is the expansile or balloon cyst. All these cysts are connected with the bronchial tree, but when the connection is of the tortuous type air may be trapped within them, producing great enlargement. The expanding chest lesion may cause severe displacement of mediastinal organs and pulmonary compression both of these were noted in Case 3 Aspiration of these cysts may lead to infection or a leak in the cyst wall, causing tension pneumothorax. Usually lobectomy or pneumonectomy is required for adequate treatment, but sometimes the primitive bud from which the cyst has developed is so separated from the rest of the lung that the cyst can be removed by ligating its pedicle

SUPPURATION—ANOMALIES

Pulmonary Lobectomy Experience with 110 Consecutive Resections without Operative Mortality in 104 men and 1 woman is reported by Bernard J Ryan[5] (Veterans' Admin. Hosp., Bronx, N Y) Operations on all but five or six patients were performed by the residents on the thoracic surgery service

There were 64 operations for bronchiectasis. Nearly every patient with unilateral disease completely eliminated at operation had good results. In seven, all but one of whom had bronchographically demonstrated bilateral disease results were poor There were 20 resections of lung for chronic lung abscess. All the patients left the hospital asymptomatic except one, still hospitalized, in whom pulmonary tuberculosis developed. Of the others, 16 are well, 2 have been operated on too recently for follow up and 1 cannot be located Lobectomy was performed for peripheral carcinoma

(5) Surgery 27 551 558 April, 1950

in five patients, of whom three are now working full time, one is well but not working and one has evidence of metastases in both lungs. In two patients with limited pulmonary reserve lobectomy was performed because of carcinoma, but both subsequently died of this disease. The five patients who were subjected to lobectomy for active tuberculosis before January 1948 are now working Sanatorium care is being given four additional patients similarly treated for this disease.

The importance of maintaining an adequate airway and dry tracheobronchial tree and providing sufficient oxygen during and after operation cannot be overemphasized. Blood transfusion was routine in all cases during operation. In all instances individual dissection and ligation silk technic were used in dealing with the hilar structures Posterolateral approach with rib resection was used in lower lobe lobectomies and most upper and middle lobe resections. The 72 hours after operation are crucial and the patient must be constantly protected against anoxia Before operation he is instructed on the importance of postoperative coughing and deep breathing Postoperative tracheal suction after Haight's method is routine There were no operative deaths, but two patients died of carcinoma several months postoperatively The commonest complications were atelectasis, empyema and bronchopleural fistula. Frequent physical and x ray examinations are imperative for the detection of these and other postoperative complications such as pneumothorax and hemothorax.

Segmental Pulmonary Resection Details of Technic and Results Richard H Overholt, Francis M. Woods and Beatty H. Ramsay[6] (Tufts College) state that there are essentially four steps in this resection (1) the segmental artery is dissected out ligated and divided (2) the segmental bronchus is cleared, ligated distally and divided and the proximal stump closed (3) the segmental vein, when present, is ligated and divided (4) the segment to be removed is separated from the lobe by locating the intersegmental vein in the hilus of the segment and following this as a guide to the intersegmental plane The first three steps are carried out in the most convenient order If subpleural

(6) J Thoracic Surg 19 207 225 February 1950.

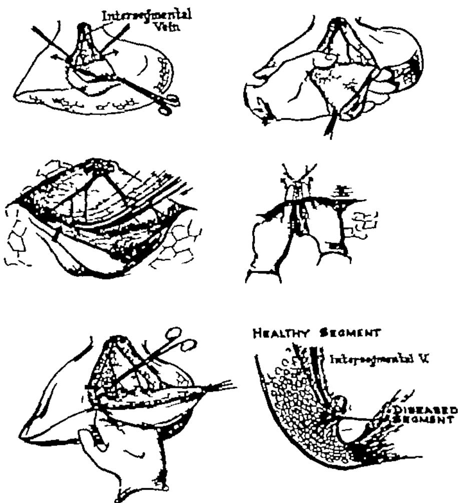


Fig. 40 (top left).—Dissection of intersegmental plane is facilitated by flattening the plane by divergent retraction of the edges and inflation of the lung.

Fig. 41 (top right).—As the plane is developed counterpressure from the pleural surface aids dissection.

Fig. 42 (center left).—Side-to-side dissecting motion and division of a venous branch.

Fig. 43 (center right).—If tissues of the intersegmental plane are normal, segments can be separated cleanly by divergent motion of the fingers inserted along the intersegmental vein.

Fig. 44 (bottom left).—Alveolar damage and air leak. Counterpressure shown is incorrect. Note flat side of the hand in Figure 41.

Fig. 45 (bottom right).—Undue traction on venous tributaries may be transmitted to the normal segment with resultant parenchymal tears.

(Courtesy of Overholt, R. H., *et al.*: J. Thoracic Surg. 19:207-225, February 1950.)

veins are draining the diseased segment, they are ligated and divided.

TECHNIC.—Exposure and gentleness are of paramount importance. Exposure is best obtained by irrigating the surface to keep

it free from blood and keeping it flattened out. Segmental margins can be gently retracted by divergent pressure at two opposite points (Fig 40) Inflation of the lung will flatten out the intervening surface Once the plane of dissection has been partially developed, counterpressure from the pleural surface at the level of dissection is of distinct aid in supporting the tissues during separation (Fig 41) The dissecting motion should be a side-to-side sweep between the intersegmental vein and its branches on the healthy side and the diseased tissue on the other side (Fig 42) The pressure is directed parallel to the plane rather than at right angles to it and may be accomplished with the rounded end of small curved scissors or the finger tip Small venous tributaries arising in the diseased segment and any fibrous strands are cut when found (Fig 42) It is simple and speedy to insert two index fingers along the central axis of the intersegmental vein, to move the fingers divergently and to separate cleanly the two adjacent segments (Fig 43) If there is considerable fibrosis in the intersegmental plane, sharp dissection is necessary Damage to the lung surface is usually the result of digging in with the dissecting instrument or pulling on venous branches (Fig 44) Traction or pulling on the venous branches is transmitted to the tributaries entering from the normal segment these are anchored in torn alveolar tissue and air leaks result (Fig 45)

Of 28 patients operated on from September 1948 to February 10 1949 10 had two segments removed and 18 one. Often these operations were combined with lobectomy In 15 patients the lung was completely re-expanded and the catheters were removed within 24 hours, in 10 within 48 hours and in 2 on the third and fifth days. Average post operative hospitalization was 14 days There were no empyemas, two minor fistulas and one death from pulmonary insufficiency aggravated by inability to raise the bronchial secretions.

Bilateral Bronchiectasis Analysis of 43 Consecutive Cases is presented by G E. Lindskog and R. D Alley[7] (Yale Univ) In approximately 30 per cent of patients, bronchiectasis is bilateral. *Resection is the only known method* for permanent and total cure. Patients in this series ranged in age from 9 to 66 years, and 18 were females Operation was not advised in 17 because of extensive involvement advanced age marked emphysema or heart disease

Bilateral resection has been completed in 12 and 8 have undergone unilateral resection. Treatment involved removal of 49 lobes in 33 operations. Of those having bilateral op-

(7) Arch. Surg. 60:465-473 March 1950

erations six have a slight cough with little or no sputum, two are entirely symptom free and four have minimal symptoms. Unilateral operation resulted in improvement in seven, one is no better and none is symptom free. Additional procedures are planned for three in the bilateral group and five who have had unilateral operations.

Individual ligation technic was used in 24 total resections and mass ligation for 9 subtotal resections Since penicillin became available it has been given pre- and postoperatively and 100,000 units is left in the pleural cavity at the end of operation. Average postoperative period for subtotal resection patients was 68 days and for total resection patients 25½ days Subtotal resection was followed by bronchopleural fistula in six, empyema in seven, atelectasis in four and pneumonitis in three Total resection was followed by bronchopleural fistula in 3 atelectasis in 14 and pneumonitis in 4 There were no operative hospital or late deaths in either group

Surgical Treatment of Bilateral Bronchiectasis. Frederick G Kergin[8] (Univ of Toronto) analyzed 58 patients, 27 of whom had unilateral and 31 bilateral operations. A total of 94 excisions were done with 4 deaths, an operative mortality of 4 per cent and a patient mortality of 7 per cent. The four deaths followed operation on the second side, a mortality of 13 per cent for bilateral operations. The deaths all occurred among the first 13 patients The last 18 consecutive bilateral resections were completed without a death. Forty-eight patients were aged 14-43 (average 22) The other 10 were aged 4-14 (average 10) The four deaths occurred in the older group The younger patients, particularly the children, stood extensive resection better than the older persons, but no definite conclusion was reached regarding the age limit for bilateral resection.

Fifteen patients showed pronounced disproportion in the distribution of the disease in that it was slight on the second side All but one of these patients had unilateral resection with satisfactory results In the other 43 the disease was severe or moderately severe on both sides. Within certain limitations, staged bilateral resection is recommended for this group It was carried out in 31 patients (Fig 46)

(8) J Thoracic Surg 19 257 269 February 1950

abandoned because of the high incidence of pleural complications and a tendency to development of bronchiectasis in the previously healthy superior segment

[When dealing with bilateral bronchiectasis it is very important to consider the individual case rather than to follow any set rules. It is often much wiser to leave a lobe with minimal or moderate bronchiectasis than to strive for a perfect result. In other words, just because there is evidence of bilateral bronchiectasis it is not always wise to submit the patient to a bilateral operation. Not only is the operative risk greater in the bilateral case but also there is a greater danger of making a respiratory cripple of a patient who is subjected to the removal of a lobe of each lung. —Ed.]

Surgical Management of Chronic "Spontaneous" Pneumothorax Report on Etiologic Factors and Surgical Treatment Employed in 15 Cases is made by Lyman A Brewer, III Frank S Dolley and Byron H Evans[9] (Los Angeles) Failure of the collapsed lung to re-expand after an attack of spontaneous pneumothorax may result in chronic invalidism and persistence of the pneumothorax may be a major contributing factor in a fatal outcome In this study only apparently healthy persons with chronic and recurring pneumothorax treated by surgery were included

Direct observation at open thoracotomy (13 cases) or by thoracoscopy (2 cases) showed some sort of cyst, subpleural bleb or bulla to be responsible for spontaneous pneumothorax in all but 1 case These findings are supported by other experiences reported in the literature Ruptured congenital cysts caused spontaneous pneumothorax in three cases, ruptured localized subpleural blebs or bullae (which may be a complication of old healed subclinical pulmonary tuberculosis) in eight and acquired blebs in association with generalized pulmonary emphysema in four

Failure of the lung to expand once an attack of spontaneous pneumothorax occurs may be attributed to intrapleural adhesions ruptured congenital cysts which because of their epithelial lining fail to heal scar tissue in wall of bullae and visceral pleural membrane In seven cases a firm visceral pleural membrane was found to limit expansion of the lungs This membrane may be formed on visceral pleura as a result of fibrin deposition from the pleural effusion that occurs in some of these cases Microscopic examination shows the membrane to consist mostly of fibrovascular tis

(9) J Thoracic Surg 19:187 198 February 1950

sue The membrane may remain as a separate layer as long as there is no infection in the pleural cavity or subpleural lesion in underlying lung

If the lung remains collapsed for more than three months after a spontaneous pneumothorax *active therapy should* be instituted In most reported cases sterile artificial pleuritis has been produced by means of irritants introduced *into the pleural cavity* However because of the mechanical nature of the condition, surgical treatment will best preserve maximal pulmonary function Surgical measures include closed catheter drainage phrenic paralysis thoracoscopy with internal pneumonolysis and thoracotomy Closed catheter drainage is useful mainly *for acute and subacute* forms of spontaneous pneumothorax Phrenic paralysis relaxes the diaphragm and decreases tension on the lung to *permit the pulmonary aperture to heal* but *it is probably* less desirable than a more direct method of treatment. Stringlike adhesions, when present, may be divided by internal pneumonolysis with resultant successful expansion Thoracotomy should probably be used as a primary procedure after the chest is opened complete pneumonolysis surgical closure of the pulmonary opening resection of the pulmonary cyst or bullae or decortication of the lung may *be performed as indicated*

METHODS —In preparing patients for operation the usual measures used for pulmonary resection should be instituted The posterolateral approach is employed *for the thoracotomy using intratracheal* anesthesia. After opening the pleural cavity sterile saline is introduced to determine the source of pulmonary rupture much as *one would examine a bicycle tire for a leak.* The site of rupture is instantly obvious when the anesthetist administers intrabronchial positive pressure After complete pneumonolysis simple resection is used for peripheral lesions, clamping the lung and closing the pulmonary tissue with mattress sutures of fine silk. Large thin walled cysts should be opened widely and resection performed with tension on the cyst wall lung tissue may be conserved by accurate identification of attachment of the *base of the cyst to lung Segmental re*section is infrequently indicated and lobectomy is contraindicated if pulmonary tissue is to be conserved. Removal of all blebs is often *technically impossible and only* those which look as though they might rupture at some future date need be resected. Decortication is performed, if necessary according to the standard technics for clotted hemothorax The lung is carefully checked for bronchial fistula before closure Tiny parenchymal bubbling coming from the

decorticated normal lung [illegible] serum and will be taken care of by drainage tubes inserted in the second or third intercostal spaces anteriorly and the sixth or seventh posteriorly and connected immediately to a closed drainage system. Postoperative care is similar to that of a lobectomy, but the postoperative course is milder. Penicillin may be administered through the anterior drainage tube daily for two to three days with the posterior tube clamped for six hours after each injection. Drainage tubes are removed on the third or fourth day since the lung has expanded and they cease to function.

In this series only surgical treatment was employed; there were no complications except for a momentary cardiac arrest which occurred during operation. In five cases decortication was followed by rapid expansion of the lung. There have been no recurrences and no deaths.

Intracavitary Suction (Monaldi) in Treatment of Emphysematous Bullae and Blebs in nine cases is reported by Jerome R. Head and Edward J. Avery[1] (Chicago). Although the surgical treatment of emphysematous blebs and bullae has been considered hopeless in the past, patients with bullous emphysema are being seen with increasing frequency.

Thoracoscopy revealed that in bullae the destructive force is that of expiration instead of inspiration, with intracavitary pressures on coughing as high as 50 mm. Hg. Most patients' complaints are referable to chronic bronchitis or asthma.

The three stage Monaldi drainage method was found superior to thoracentesis, thoracoplasty or lipiodol® injections, especially in poor surgical risks.

TECHNIC.—Several oblique and lateral x-ray views are taken. Films are exposed a few kilovolts lighter than normally because of the decreased density of lungs in these cases. The point of optimal drainage is chosen by selecting a site at which the bleb is adjacent to the chest wall. Under local anesthesia an extrapleural exploration is done and pleural symphysis is produced with gauze packing. Later the packing is removed and the wound allowed to heal. Pressure readings are taken, thoracoscopy is done and biopsy is performed if possible. A multiple fenestrated catheter is then placed well into the cavity, sealed at the skin edges with an airtight dressing and connected to a water-seal bottle. If air continues to escape through the bottle and the lung shows no evidence of re-expansion after a few days, a Stedman suction pump is added and adjusted to maintain a negative pressure of —10-20 cm. water. Re-expansion occurs

(1) J. Thoracic Surg. 18:761-776, December 1949.

in one to three weeks but the catheter is left in place a few more days to cause inflammatory obliteration of the space

Three of the authors cases follow

CASE 1.—Man, 50 had chronic severe dyspnea, acute abdominal distention and a history of asthma and chronic appendical abscess. At exploratory laparotomy adhesions were cut to relieve a small bowel obstruction Postoperatively, intracavitary suction was performed re-expansion of the left lung occurred in 10 days. The right lung was similarly treated with a resulting increase in vital capacity from 950 to 3,550 cc The patient was no longer bedfast with dyspnea.

CASE 6.—Man, 68, had had progressive dyspnea for 20 years. After an extrapleural pack was inserted, he became more cyanotic and sank into coma. Decompression was complicated by a tension pneumothorax requiring drainage Re-expansion occurred in one month. Subsequently, the patient was active about his home.

CASE 7.—Boy, 10, was admitted because x rays revealed he had no left lung markings. Drainage was complicated by sepsis after insertion of the catheter and was attributed to a possible epithelium lined cyst. This could have been avoided by careful thoracoscopy and biopsy of the wall

Cavernous Hemangioma of Lung James H Forsee, Hugh W Mahon and L A. James[2] (Fitzsimons Gen'l Hosp, Denver) report a typical case in which a diagnosis of pulmonary tuberculosis was first made This condition is characterized by appearance in a young adult, cyanosis, clubbing of the fingers and toes, polycythemia, normal heart, obscure lung tumor or infiltration, and often a murmur over the involved portion of the lung There is occasionally a family history of hemorrhagic telangiectasia.

Youth, 20 with an area of infiltration in the right upper lung field, was being treated for pulmonary tuberculosis with no improvement in the lesion. On the suggestion of a physician that the lesion was probably not tuberculous but vascular, an angiocardiogram was made It showed an arteriovenous shunt in the right lung with slight dilatation of the pulmonary artery Valsalva's test indicated that the lesion was of vascular origin. On the basis of these studies and presence of cyanosis and clubbing of the fingers, exploration of the right thoracic cavity was done Massive large venous dilatations were seen on the posterior surface and near the interlobar fissure of the right upper lobe Lobectomy was done, with immediate improvement in the cyanosis of the face. Cyanosis of the fingers and hands completely disappeared in two months.

Microscopically, the surgical specimen comprised a nonencapsulated cavernous hemangioma composed of groups of dilated, thin

(2) Ann. Surg. 131 418-423 March, 1950

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total of 108 thoracoplastic operations was performed riation in the techni deserves mention In about half ases the transverse process of the first rib was left in second group this process was removed There is no

Dis Chest 14 187 215 Mar[illegible]

additional technical difficulty, and the resulting anatomic collapse compared favorably with that in the first group X rays show that regeneration of the bony plate sets in closer to the spine and the gutter between spine and bony plate fails to develop The upper portion of the lung seems anatomically better collapsed Streptomycin was used pre and postoperatively in alternate cases, incidence of post operative spreads was definitely higher in the nontreated group In treatment of pulmonary lesions the greatest value of the drug is in conjunction with surgical procedures designed for collapse or removal of diseased parts But about 60 per cent of treated patients seem to develop resistance to the drug and after 60 days it seems that resistance must be expected regardless of dosage Attention is drawn to the fact that in some cases it is best to keep the antibiotic in reserve for a late stage of therapy In the thoracoplasty series there have been a number of giant cavities some with marked sputum production. A somewhat different approach was used satisfactorily thoracoplasty in reverse order i.e., from below upward will close a higher proportion of these cavities

Twelve resections were performed without mortality All patients were given streptomycin for one week preoperatively and for 60 days postoperatively The only complication was a contralateral spread in a pneumonectomy Resection was routinely followed by limited thoracoplasty procedures to avoid overdistention of the remaining parenchyma General agreement has been reached as to the indication of resection for isolated tuberculoma, thoracoplasty failure and uncollapsible lower lobe cavity also, when severe bronchostenosis is present and thoracoplasty is therefore contraindicated. The difference of opinion now centers on the group of so-called predicted thoracoplasty failures, i e the group of cases of destroyed lungs in which there is a great amount of disease but no severe bronchostenosis The authors are inclined to recommend that thoracoplasty be done first to be followed later by resection if conversion is not obtained

There were 14 thoracoplasty failures Ten patients were treated by a modified type of thoracoplasty revision combined with open intrapleural freeing of the lung and fixa

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Surgical Therapy of Pulmonary Tuberculosis at Veterans Administration Chest Center Ralph Friedlander and William M Chardack[4] (Castle Point N Y) selected for review the period from March 1947 to March 1948 during which 145 major procedures were carried out without mortality The complications encountered were five tuberculous spreads and one each of tuberculous wound infection pyogenic wound infection (abscess) cardiac decompensation and wound disruption

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(4) Dis. of Chest 16 197 213 August 1949

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less than one year, were living and well. Of the 14 benign tumors, 6 recurred, 3 of these showing sarcomatous change. Of the 11 patients who had malignant tumors, 6 died within 18 months after surgery. Two of the surviving five and four of the six who died had had postoperative roentgen therapy.

Fibrosarcoma. Clinical and Pathologic Study of 60 Cases *(23 in males and 37 in females)* was made by Elwyn L. Heller and William K. Sieber[3] (Pittsburgh). Although these tumors may arise from almost every tissue of the body, their origin is predominantly from deep fascial planes and from muscle and nerve sheaths of the trunk and extremities. In nine patients factors of possible etiologic significance included trauma, chronic irritation and pre-existing benign lesions. Development of malignancy in benign lesions was the most significant etiologic factor.

The clinical course is unpredictable, of great variability *and dependent on the growth peculiarities of the tumor* itself and on its anatomic site. The chief complaint was usually that of a palpable tumor mass, but in 18 patients pain was a prominent symptom. Duration of symptoms varied from several weeks to 32 years. Follow up data were not available on 11 patients, but 37 were followed to death and 12 patients are living. Average length of survival after appearance of symptoms was *31½* months *and average* time interval from appearance of symptoms to diagnosis, 11 months.

Grossly the tumors varied from the firm fibrous character of the well differentiated tumors to the soft fleshy hemorrhagic tissue of the more anaplastic types. Histologically they varied in cellularity, amount of stroma, vascularity, *pleomorphism, cell maturity and frequency* and character of mitoses. There was no close correlation between histologic grading and clinical course.

Of the 21 patients treated by surgical excision, recurrences are known to have developed in 11. In three a progressive increase in the degree of malignancy was demonstrated with each successive recurrence. Of the 12 living patients, 4 have survived for more than three years. Of these three were treated by radical excision and one by

(3) Surgery 27 539 545 April, 1950

local excision and x rays X ray therapy alone resulted in no cures

Malignant Melanoma of Skin has been said to arise from pre-existing moles in about 65 per cent of cases, but the experience of Lauren V Ackerman[9] (Washington Univ) indicates a lower percentage He found that the most common mole to undergo malignant change was a brown, flat, hairless soft mole which microscopically is often associated with junctional changes Prophylactically any mole should be removed which is subjected to chronic irritation or is undergoing increased pigmentation or growth or ulceration Because of the high frequency of junctional moles on the genitalia and below the knee and of malignant melanomas, particularly on the legs such moles should always be removed as well as any mole on the plantar surface of the foot or on the subungual area

Clinically the usual malignant melanoma is readily recognized There is often a history of a pre-existing mole which darkened increased in size and ulcerated It is often elevated and is most commonly located on the head neck or legs If a pigmented tumor occurs near the hairline or on the subungual area or leg chances are fairly good that it is a malignant melanoma Only relatively nonpigmented lesions engender difficulty In such instances a careful incisional biopsy will not be harmful Probably one of the most difficult problems confronting pathologists is differentiation between a benign and a malignant melanoma.

Treatment of these tumors must be surgical Irradiation has proved unsatisfactory, for the tumors are truly radioresistant Local excision by cold steel is preferable to cautery If the tumor is located fairly close to its draining lymph node group dissection in continuity seems justifiable Prognosis is good at the prepuberal age since the tumors are practically never malignant. It is good for the slow spreading malignancy often seen on the face in which regional lymph node dissection is not indicated, and for the tumor located on the head or neck in which radical excision is followed by regional node dissection. Prognosis is poorer when the tumor is located on a leg or on an area in which

(9) Texas State J Med. 45 735 744 November 1949

lymph node metastasis is not predictable, such as the abdomen.

Of 75 cases, 22 were hopelessly far advanced There were only 21 patients in whom it was possible to do radical excision and radical lymph node dissection. Eight of these survived five or more years, three of the eight had involved regional lymph nodes Five year survival in this group does not mean cure for it is common for the tumor to recur 10-15 years after removal of the primary lesion

Xanthoma and Giant Cell Tumor of Hand are discussed by Thomas W Stevenson[1] (Columbia Univ) whose report is based on observation of 50 patients

Giant cell tumors are usually hard lobulated and fixed



Fig 5—Multiple xanthoma of hands. (Courtesy of Stevenson, T W: Plast. & Reconstruct. Surg 5 75-87 January 1950)

to ligaments, periosteum or tendon sheaths They grow by expansion rather than infiltration and do not metastasize The overlying skin is thinned and sometimes adherent. On cut section color varies from orange to gray These tumors are not radiosensitive or amenable to nonsurgical therapy Excision is the treatment of choice, but there is a high re-

(1) Plast & Reconstruct. Surg 5 75 87 January 1950

currence rate because the apparent capsule is often infiltrated by cells of the lesion so that complete removal is not always possible Microscopically these tumors show spindle shaped connective tissue cells with collagenous fibers, multinucleated giant cells and large phagocytic cells which contain lipoid material

Xanthomas often occur in young persons and sometimes on a familial basis They may be associated with diabetes or hypercholesterolemia (500 800 mg /100 cc) In some cases the cholesterol level can be lowered with subsequent disappearance of xanthoma nodules These tumors are usually multiple and are distributed symmetrically on the fingers (Fig 5) elbows buttocks knees ankles, heels and toes with occasional scattered cutaneous nodules and eyelid deposits The cutaneous masses are hard red to orange and nodular The overlying skin is usually adherent Xanthoma tissue often infiltrates widely and without the apparent encapsulation of the solitary giant cell tumor Excision is seldom complete and recurrence is the rule except in rare cases in which the blood cholesterol can be reduced. Management is often difficult because the blood supply is reduced and the growths are located over bony thin skinned prominences Closure under tension frequently fails because resistance to infection is low Free grafts may be complicated by marginal recurrences Ulceration or interference with function so that temporary relief is acceptable is a clear indication for surgery

Thermal Coagulation of Serum Proteins in Cancer, in Postoperative Phase of Surgery and in Administration of Adrenocorticotrophic Hormone To determine whether an extensive and invasive cancer of the colon would yield a much lower index than a superficial basal cell carcinoma of the skin Oscar Bodansky and George F McInnes* (New York City) studied the relation between the type of cancer and the serum protein coagulability as determined by the value of the iodoacetate index or by the lowest protein concentration necessary to undergo thermal coagulation They attempted also to ascertain whether the iodoacetate index could be used in determining the effectiveness of removal of a cancer and the onset of possible recur

(*) Cancer 3 1 14 January 1950

rence It is well known, for example that a decrease in serum alkaline phosphatase activity parallels removal of osteogenic sarcoma and a rise heralds its recurrence

The thermal coagulation of serum protein, as defined by the iodoacetate index, was determined in 68 healthy subjects, 68 patients with noncancerous disease and 137 with cancer The distribution of the indexes in these groups made it impossible to choose a range of iodoacetate indexes sufficiently inclusive of the values in healthy subjects and sufficiently exclusive of those patients with cancer to form the basis of a useful diagnostic test Patients hospitalized with cancer had in general lower indexes than patients with cancer who were able to attend the clinics. Surgery on patients with or without cancer led to a decrease in the iodoacetate index level during the immediate postoperative period Administration of ACTH led to a decrease in the iodoacetate index level and the values rose again when this administration was discontinued.

On the basis of these data and of certain reports in the literature it was concluded that the qualitative defect in the serum proteins, which is revealed by thermal coagulation tests is not specific for cancer but is merely one manifestation of the organism's reaction to noxious stimuli.

[The thermal coagulation of serum proteins which was suggested by Charles Huggins of the University of Chicago as a test for cancer is thus found by Bodansky and McInnes not to be specific. Too bad! Someday such a test will probably be found.—Ed.]

Serodiagnostic Screening Test for Cancer is described by Irwin H. Olenik[8] (Bronx, N Y) With this test, accuracy in 46 cases of proved malignancies was 91.3 per cent and in 72 nonmalignant cases 91.6 per cent.

METHOD —To each of three test tubes 1 cc. plasma is added. To test tube 1 2 drops of 0.05×10^{-6} sodium fluorescein solution is added, and all tubes are stoppered with oil-silk paper and a cork. After 24 hours, 2 drops fluorescein solution is added to test tube 2. The tubes are rotated to mix the contents, wiped clean and exposed to Wood light rays so that only the most perpendicular rays strike the solution If fluorescence in the tubes is the same, it is a negative reaction. With a positive reaction intensity of the fluorescence in tube 1 is diminished and the green element disappears leaving either the yellow or white. The difference is always distinct. Tube 2 is the control for comparing fluorescence changes which may have taken place over 24 hours. After 48 hours from the start of the test, 2

(8) New York State J Med. 50 573-575 March 1950

drops sodium fluorescein solution is added to tube 3 and the procedure repeated as with tube 2, unless the reaction was positive after 24 hours. Changes after 48 hours are not significant.

Beginnings of Chemotherapy in Neoplastic Diseases Ludwig Heilmeyer[4] (Univ. of Freiburg) comments that the dramatic results and wide use of chemotherapy in bacterial infections have raised the hope that cancer might also yield to chemical agents and that methods evolved in bacteriostatic testing might be applied to neoplastic disease. However, the two conditions are not alike, in that bacteria are foreign to the body whereas cancer cells are endogenous and differ no more from normal than do the cells of one organ from those of another. This makes selective action necessary; though difficult, such action is possible. The most promising attack would be on mitosis; the cells in the body which divide most rapidly, the blood building cells, could be used as guides, and if agents did not destroy them the dosage would be safe.

A second factor which makes attack on cancer cells difficult is the lack of resistance the human organism has toward them. The effect of chemical agents is not their destruction but a weakening and hinderance of their growth. For this reason radiation and chemotherapy cannot be expected to have more than temporary effects.

Several groups of chemical agents have been employed in neoplastic disease: (1) cytostatics such as colchicine, acriflavine and arsenicals (they tend to lower resistance to infection); (2) agents which impede mitosis such as urethane, mustard gas and stilbamidine* (these may cause gastrointestinal disturbances), (3) carcinogenic agents, e.g. benzpyrine and dimethylbenzathracene, (4) metallic salts of copper, nickel and cobalt, (5) pyrogens, and (6) hormones. Radioactive agents are physical and not chemical agents.

Beneficial results have been obtained in leukemia and lymphogranuloma with urethane; however, complete cures have not been reported. Mustard gas affects lymphogranuloma, lymphatic leukemia and some sarcomas favorably. Skin cancer has been cured by benzpyrine. Cystine and ascorbic acid compounds are said to block cell growth.

(4) Schweiz. med. Wchnschr. 79 539-547, June 18, 1949.

Pyrogenic agents cause involution of the tumor with substitution of connective tissue

Hormone therapy offers great hope in neoplastic disease Hormone therapy of prostatic cancer gave encouraging results and led to an attempt on mammary cancer where it failed. Combination of several chemical agents seems promising when one renders the cell sluggish and more susceptible to the effect of others

The satisfactory results to date are few but impressive Certain basic principles have evolved and results of research should improve when the human tumor cell is cultured outside the body The final test, however must be on living man

Migrating Thrombophlebitis Associated with Carcinoma. Edward A. Edwards[5] (Tufts College) reports six cases and reviews 23 from the literature. The primary site of cancer was in the tail or body of the pancreas in 16 stomach in 4, lung in 4, gallbladder in 2 and undetermined in 3 Patients with this syndrome are of middle or old age and of both sexes. However there is a predominance of men. The patient may present himself because of the venous disease without suspecting carcinoma Inflammation of superficial veins of the legs or forearms is the usual initial complaint. Deep calf tenderness and edema suggest involvement of deep leg veins and pain over sacral or hip regions suggests pelvic phlebitis Thrombophlebitis appears at one or more sites at the outset. Temperatures up to 100.5 F are common, though white cell count is generally unchanged The fever is not influenced by penicillin as in the usual nonseptic forms of thrombophlebitis Multiple pulmonary emboli are common but may be small and so unrecognized. Once the process has started new attacks and exacerbation in previously involved segments occur rapidly until death. There is a striking lack of arterial thrombosis

The cause of the thrombosis is unknown but there is no malignant infiltration of the vessel wall and inflammation of the wall is generally absent Clinically it must be differentiated from migrating phlebitis of thromboangiitis obliterans and from the more common idiopathic thrombophlebitis

(5) New England J Med. 240 1031 1035 June 30 1949

Treatment is secondarily important to the search for the responsible neoplasm. Investigation of the pancreas, stomach and lung should be vigorous. Exploratory laparotomy should be performed if carcinoma is not established by other methods.

[This amazing condition is so impressive that one who has seen a case is not likely to forget it. Why there should be so remarkable a relationship between cancer of the body or tail of the pancreas and multiple venous thromboses is something for which there is not the remotest explanation at the present time. Could it be that a specific thrombosing substance is liberated in a cancer which grows in that tissue? Again, there is the remarkable fact that only the veins and not the arteries are the sites of thrombosis.—Ed.]

SKULL—BRAIN

Acute Subdural and Extradural Hematoma in Closed Head Injuries. Walpole Lewin[6] (Oxford) reports experiences in 29 cases of acute extradural hematoma and 21 of *acute subdural hematoma. There were 15 deaths in the* first group: 2 because the hematoma was not diagnosed, 4 because of late intervention, 3 because the hematoma was not found at operation, 4 because of cerebral contusion and 2 from other causes. There were 13 deaths in the cases of acute subdural hematoma; 8 were due to cerebral contusion and laceration.

In 20 cases of acute extradural hematoma the findings conformed to the classic description. After a head injury there was a short period of unconsciousness followed by a lucid interval. One half hour to three days later symptoms reappeared. In nine cases head injury was more severe, there was no lucid interval and full consciousness was not regained. Common signs in all cases were deterioration of the conscious level, scalp bruising or laceration over the hematoma, localizing signs, skull fracture, eye signs, lucid interval, pulse less than 60/minute, cerebrospinal fluid pressure over 200 mm. or pineal shift in x-rays. In 21 cases the hematoma was found in the temporal fossa, originating either from the main trunk of the middle meningeal artery or more commonly from one of its branches.

(6) Ann. Roy. Coll. Surgeons England 5:240-274, October 1949.

Acute subdural hematoma most often follows a severe head injury with decided cerebral contusions. Cortical vessels are torn and blood enters the subdural space through tears in the overlying pia-arachnoid Other cases may follow laceration of one of the great venous sinuses Most patients in this group had symptoms within 48 hours of injury All patients lost consciousness initially and in only nine was this for less than an hour A car accident was the cause in 71 per cent, in none was injury due to a local blow to the head Localizing signs so reliable in lateralizing extradural hematoma are unreliable in subdural hematoma. Diagnosis is complicated by underlying cerebral contusion and bleeding into the subdural space which is frequently bilateral The latter occurred in 29 per cent of this series.

Once an extradural hematoma is diagnosed operation should be done immediately The principle of burr hole exploration with subsequent enlargement if necessary is the generally accepted method The correct site for initial exploration is indicated by the localizing signs, position of the fracture lines and site of scalp bruising or laceration. The whole head should be shaved to permit full inspection of the scalp and the making of several burr holes if necessary If the clot is found at the first exploration and adequately explains the signs routine exploration of the other side is unnecessary since bilateral extradural hematomas are rare In the uncomplicated case the dura need not be opened. It should certainly be done when there is clinical evidence of underlying pathologic conditions as judged by an initial unconsciousness of an hour or more or presence of blood in the cerebrospinal fluid. A drain may be left in place 48 hours if there has been *considerable oozing from the* dura and if the dura has not come up flush with the bony defect so that a dead space remains.

A provisional diagnosis of subdural hematoma can usually be made but if there are no localising signs or a heavily blood-stained cerebrospinal fluid has suggested subdural hematoma a parietal burr hole is made Since subdural hematoma is frequently bilateral both sides should be explored Bleeding has usually stopped by the time operation is performed so it is not customary to find a bleeding point in these cases In most instances the hematoma is mainly

fluid, and on opening the dura the blood readily escapes Usually a second burr hole is made on the same side as the hematoma and the subdural cavity is irrigated with warm Ringer's solution until the washings are clear Since the brain usually begins to expand immediately to obliterate the dead space no drain need be inserted but as an alternative the dura is left widely open and the subgaleal space opened by undermining the scalp incision so that any more blood may readily escape into this space and be absorbed The wound is then closed in layers When the hematoma is solid it may be possible, by enlarging burr holes to remove it with suction and irrigation otherwise an osteoplastic flap will have to be turned A major operative problem is encountered when after removal of the subdural hematoma the cortex bulges through the dural opening This may be due to localized brain swelling existence of an extradural or subdural hematoma elsewhere intracerebral clot or severe cerebral contusion Presence of localized brain swelling further favors placing at least two burr holes on the side of the hematoma. If other hematomas are suspected the case must be reviewed from this aspect and appropriately treated If after evacuation of a subdural hematoma a cortical clot can be seen through the burr hole it may be removed by suction after enlarging the bony opening Such a procedure was attempted with success in three cases in this series When an intracerebral clot does not present at the surface, routine exploratory needling is likely to be both dangerous and ineffective Though severe cerebral contusions are not primarily surgical problems and many are essentially fatal injuries in selected cases favorable results may follow subtemporal decompression or elevation of a frontal bone flap on the side indicated by the clinical signs, and removal of damaged brain and clot.

Although even those patients who recover well after evacuation of a surface hematoma do not usually regain full consciousness rapidly failure to show some improvement after operation should be regarded with suspicion The chief complications may be recurrent bleeding, low pressure state or cerebral edema To be treated successfully recurrent bleeding must be recognized early and reoperation performed Contrary to the usual postopera

regimen for chronic subdural hematomas the head down position is contraindicated in persons with acute cases because if the source of the bleeding has been venous the resulting increased venous pressure may well reinstitute it The mechanism of the low pressure state is not well understood, but the clinical picture may closely resemble that of a recurrent clot without lateralizing signs Cerebral edema was not observed postoperatively in this series. Whereas local edema around damaged brain is common, general edema is uncommon in these cases and, if there is no cerebral damage does not occur in extra or subdural hematoma

Of 12 patients with acute subdural hematoma and 26 with extradural hematoma who were followed for two to eight years, all returned to full time work or to school. Only four have had or continued to have epilepsy once the immediate effects of the acute injury were over

Unilateral Prefrontal Lobotomy for Relief of Intractable Pain and Termination of Narcotic Addiction was carried out by John E. Scarff[7] (Columbia Univ) in 33 patients. After follow up periods of 1 10 months it was ascertained that 22 patients had good results, i.e., they never voluntarily complained of pain or required narcotics postoperatively Their preoperative pain arose from a variety of pathologic processes carcinoma of tongue jaw, pancreas and bladder metastases of carcinoma to long bones, spine and pelvis neuritis of the cauda equina advanced arthritis thoracic aorta aneurysm atypical face pain, and trigeminal neuralgia. Results were fair in six patients and poor in five, in whom the disease and its site were as varied as in the 22 with good results.

Pre and postoperative psychometric evaluations in 15 patients disclosed no significant differences between the scores of 11 whereas the scores of 4 showed lowering ranging from 13 to 23 points. In each of the latter were factors other than operation which might have contributed to the lowered score Six given psychometric tests shortly after operation and repeated tests several weeks later showed a substantial gain over the first test. Evaluation of the principal categories of intellectual activity showed no charac

(7) Surg., Gynec. & Obst. 89 385-392, October 1949

teristic improvement or impairment in any field after unilateral prefrontal lobotomy Only 1 of 15 patients showed any decrease in social adjustment as evidenced by the Rorschach test In no instance did friends or relatives com

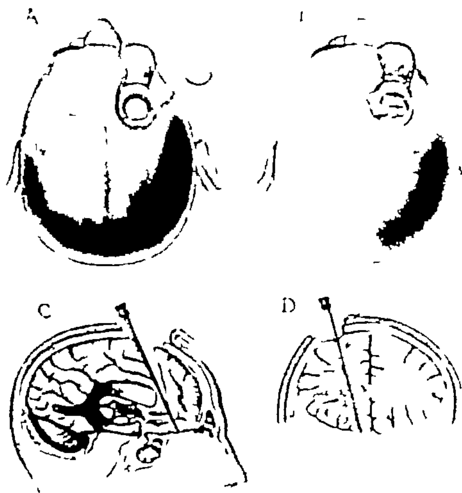


Fig 4.—Scarff technic for performing unilateral prefrontal lobotomy under direct vision. *A* relation of incision and trephine opening to coronal suture *B* cortical incision corresponds approximately to coronal suture *C* anterior tip of lateral ventricle is located with ventricular needle and plane of section established immediately anterior to it *D* in plane of section, white matter is divided in radial fashion until gray matter is everywhere encountered (Courtesy of Scarff J E Surg. Gynec. & Obst. 89:385-392 October 1949)

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Unilateral lobotomy permitted withdrawal of narcotics without withdrawal symptoms in 15 patients addicted to use of drugs in varying degrees because of pain Withdrawal

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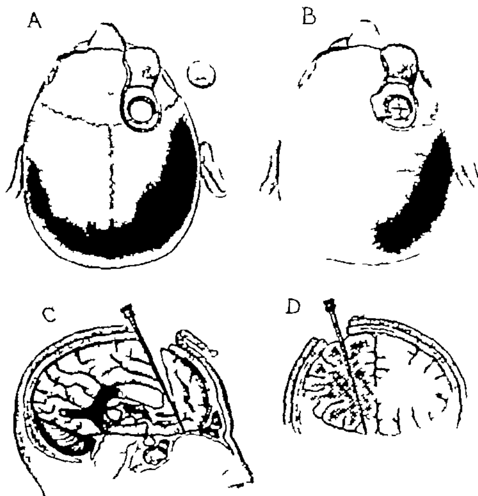


Fig. 6 —*Scarff's technic for performing unilateral prefrontal lobotomy under direct vision. A* relation of incision and trephine opening to coronal suture *B* cortical incision corresponds approximately to coronal suture *C* anterior tip of lateral ventricle is located with ventricular needle and plane of section established immediately anterior to it *D* in plane of section, white matter is divided in radial fashion until gray matter is *everywhere encountered. (Courtesy of Scarff, J E. Surg Gynec. &* Obst. 89:385-392 October 1949)

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The central portion of the lip is stuck down on the underlying bone of the premaxilla. If this sulcus is not constructed as a first stage in the operation, some difficult skin grafting will be necessary later. However successful this may finally be, the muscles will never have developed well. To construct the sulcus, advantage is taken of the way in which a raw surface surrounded by mucous membrane will epithelize quickly without contraction.

3 Forward displacement of the premaxilla. When there

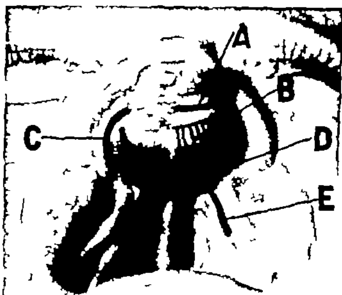


Fig. —View of complete double cleft lip from below. *A*, line of incision to cut central portion of lip free from premaxilla. *B*, area to be made raw to fuse with flap of mucoperiosteum. *C*, line of incision to free nostril. *D*, bulge showing suture line between vomer and prevomerine bone. *E*, line of incision to turn down flap of palatal mucoperiosteum. (Courtesy of Browne, D.: A. Roy. Coll. Surgeons England 5: 169-187, September 1949.)

is a cleft of the gum, new bone forms in front of the vomer between it and the premaxilla driving the latter forward. The vomer itself does not grow and the division between it and what may be called the prevomerine bone is marked by a cartilage filled suture line. The premaxilla must be placed in its normal position and firmly fixed. To get a good result it is necessary to remove the prevomerine bone, cut the premaxilla free from the nose and the central part of the lip which adheres to this, and cause junction of it and

the alveolar ridge, on both sides preferably, but on one side at least

4. Cleft of the floor of the nostril In addition to the lateral shifting that produces the wide gap there is displacement caudally or downward of the outer end of the ala of the nose that must be corrected simultaneously Three main points must be observed (1) a far better nostril will be

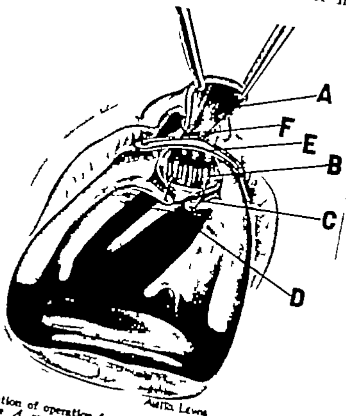


Fig 6 —Completion of operation for replacement of premaxilla and construction of labiogingival groove A raw undersurface of central portion of lip cut free from premaxilla B raw surface corresponding to A C flap of mucoperiosteum turned down off anterior angle of hard palate and sewn to patch made raw on posterior aspect of premaxilla D stitch fixing retaining bar through alveoli E retaining bar with spikes driven into bone of premaxilla F loop of suture tying bar to nasal septum. (Courtesy of Browne D Ann. Roy Coll Surgeons England 5 169 187 September 1949)

formed by sewing a short piece of skin that appears to belong to the lip just to the outer side of the nostril to a corresponding raw edge lying inside the nostril on the nasal septum (2) in freeing the nostril and cheek from underlying bone the incision on the inner side of the nostril should run quite close to the skin edge leaving the posterior

part of the ala in its original place adherent to the maxilla, (3) the gap in the bone needs a force to pull it together, and this can be supplied by the contraction in healing of the raw undersurface of the floor of the nostril that is left by simple joining of the surface

5 Cleft of the lip The best way to join the lip will be to imitate the manner of junction that should normally have occurred. Since muscles are involved in the cleft and their correct postoperative action is needed for a good result, they should be treated according to the orthopedic principles established in managing similar muscular gaps elsewhere It is obviously impossible to imitate the process of lip formation, but three main principles emerge from consideration of it (1) no skin of the lateral portions meets

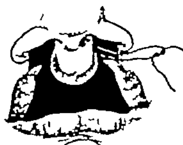


Fig. 9 —Stitching of floor of nostril. Linen mattress suture joins skin just outside the nostril on outer side to mucosa on septum just within it. (Courtesy of Browne, D. Ann. Roy Coll. Surgeons England 5:169-187 September 1949)

below the central portion (2) the central portion forms no part of the red margin (3) the muscles meet and join under the skin of the central portion. The correct surgical formula should observe these principles and also take into consideration the present conventions of beauty of the human lip

Correction of the deformity consists of two stages The object of the preliminary operation is to get the premaxilla firmly fixed in its correct position and to construct a proper labiogingival sulcus (Figs 7 and 8) The operation should be performed at about age 3 months and an interval of about one month should be allowed between it and the joining of the lip Figures 9 13 illustrate the various steps of the second operation to join the floor of the nostril and the lip itself

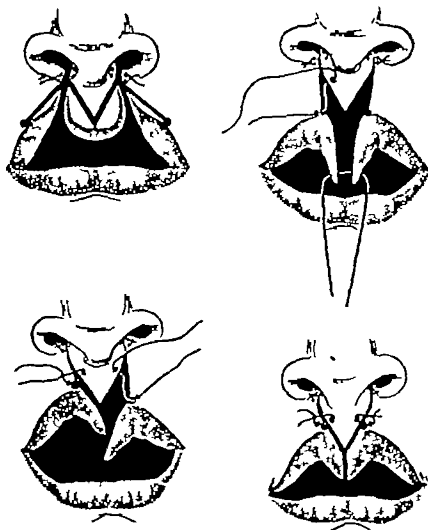


Fig. 10 (top left).—Cutting of the lip. Trephine holes are made level with tip of the V into which central portion has been cut, and are connected to raw surfaces stitched to septum by cuts with chisel-knife. Strips of skin attached to the hooks of mucosa thus formed are trimmed off with fine scissors.
Fig. 11 (top right).—Appearance when hooks are held down by temporary stitch and first stitch is inserted. It slopes acutely downward from center of the side of the central portion to trephine hole on mucocutaneous border.
Fig. 12 (bottom left).—First crucially important stitch is tied; this bends mucocutaneous line so as to form one half of a cupid's bow.
Fig. 13 (bottom right).—Eventual shape of lip defined by two primary sutures. All that is now needed on anterior lip surface is fine adjusting sutures.
(Courtesy of Browne D. A. n. Roy. Coll. Surgeons England 5:169-187 September 1949.)

Epithelioma of Lower Lip Evaluation of Dissection of Cervical Lymph Nodes. Edward S Judd, Jr., and Oliver H Beahrs[1] reviewed the 802 cases seen at Mayo Clinic from Jan 1 1930 *through 1939 primarily to determine survival*

(1) Arch. Surg 59:422-433 September 1949

rates according to grade of malignancy and type of treatment to the neck, 28 patients were inoperable when hospitalized and received only palliative treatment, 738 (95 8 per cent) received surgery for the primary lesion, 14 (1 8 per cent) received radiation therapy and 22 (2 9 per cent) were not treated because previous treatment had been satisfactory Of 738 operated on, 2 died (0.27 per cent) Of 357 in whom bilateral suprahyoid neck dissection alone or with unilateral block dissection was performed 1 died (0.28 per cent) There were no deaths among patients in whom prophylactic neck dissection had been done Cervical nodes were palpable in 31 per cent half of them were small. Five year survival rates are shown in the table

FIVE YEAR SURVIVAL RATES IN EPITHELIOMA OF LOWER LIP ACCORDING TO TYPE OF TREATMENT TO NECK

Type of Treatment	Grades 1 & 2			Grades 3 & 4		
	Patients Traced†	Lived 5 Yr or More after Treatment		Patients Traced†	Lived 5 Yr or More after Treatment	
		No.	%		No.	%
Primary group*						
No treatment	182	154	84.6	5	2	40.0
Prophylactic suprahyoid dissection	105	93	88.5	26	19	73.1
Prophylactic irradiation	55	46	83.6	6	5	83.3
Suprahyoid + block dissection	5	2	40.0	2	1	50.0
Irradiation	0	0	0	0	0	0
Total	347	295	85.0	39	27	69.2
Secondary group*						
No treatment	60	51	85.0	4	3	75.0
Prophylactic suprahyoid dissection	106	91	85.8	31	24	77 4
Prophylactic irradiation	15	9	60.0	4	2	50.0
Suprahyoid + block dissection	13	6	46.1	13	6	46.2
Irradiation	1	0	0	3	0	0
Total	195	157	80.5	55	35	63.6
Total series	542	452	82.8	94	62	66.0

* Primary group—patients who had not received previous treatment to the lips secondary group—patients who had received previous treatment.
† Inquiry as of Jan. 1 1949 In 30 cases grade of malignancy was not stated.

For patients with clinical evidence of metastasis to the cervical lymph nodes bilateral removal of the submaxillary

glands and lymph nodes and the submental nodes and unilateral dissection of the upper deep cervical nodes on the involved side are indicated. Block dissection of the anterior triangle of the neck with removal of the sternocleidomastoid muscle and the internal jugular vein is carried out when the upper deep jugular nodes are involved or the suprahyoid mass is large Interstitial radiation is recommended when the nodes are considered inoperable or the lesion is grade 4 Prophylactic irradiation is considered a placebo

For patients without clinical evidence of cervical metastatic lesions but with palpable nodes considered negative or without palpable nodes, prophylactic suprahyoid node dissection is recommended under certain conditions

If the labial lesion is grade 1, neck dissection is not advised unless the lesion is of long duration, large infected, with considerable inflammatory reaction about it, and probably of secondary character Most metastatic lesions are grades 2 and 3, therefore, prophylactic dissection of nodes is recommended in all except a few patients whose age or general condition does not permit major surgery In an occasional case in which the grade 2 primary lesion is treated early and is small, neck dissection might be omitted. In early grade 4 lesions prophylactic neck dissection may be done, but usually there has already been metastasis and the lesions frequently are inoperable

Factors favoring prophylactic dissection of cervical nodes are the opportunity for removal of early metastatic lesions, prevention of metastasis by surgical blocking off of the lymphatics, low mortality rate of suprahyoid dissection and high survival rate among patients so treated

Combined Radical Cervicofacial Procedures for Primary Facial Cancer are discussed by Ian Macdonald[2] (Univ of Southern California) Squamous carcinoma, melanoma or mixed salivary gland tumors of the parotid originating in the auricle or adjacent skin require radical surgery From these sites a continuous chain of lymphatic metastases may develop Metastasis starts first in the local periauricular nodes, then spreads in an almost arborescent pattern around or within the cervical tail of the parotid gland and thence to the adjacent submandibular lymph nodes Lesions in or

(2) Surg., Gynec. & Obst. 90 16- 0 January 1950

anterior to the auricle are more prone to metastasize into the anterolateral triangle, whereas those of retroauricular origin extend also into the posterior cervical triangle.

Effective surgical treatment of these neoplasms requires application of the same principles of cancer surgery used elsewhere in the body Such application implies a certain disregard for the niceties of cosmetic end results With extensive lesions of the ear, the entire ear must be removed, and sometimes tumor extension will necessitate mastoidectomy, ablation of the middle ear or resection of the mandible with temporomandibular disarticulation Resulting defects in the area of the primary lesion can sometimes be reconstructed by use of sliding flaps from the adjacent skin or scalp, less commonly by immediate split or full thickness skin grafts

The extent of cervical block dissection should be as wide as is consistent with a reasonably low postoperative mortality and minimal impairment of function. Removal of the internal jugular vein and sternocleidomastoid muscle should be a part of standard procedure in any cervical dissection. Other neck structures may be removed, but the common and internal carotid arteries and the vagus, phrenic lingual and hypoglossal nerves represent vital anatomic landmarks to be preserved intact. Dissection should begin at the level most distal from the primary site or at the floor of the supraclavicular space After dissection has been carried upward and the primary site widely and deeply excised the primary tumor is removed in one continuous block with the products of neck dissection. If closure is not possible the neoplasm is ulcerating or infected or there is periosteal or osseous involvement, cautery destruction of the primary tumor itself may be a superior technic.

Among 13 patients treated according to these recommendations there was one postoperative death Sufficient time has not elapsed postoperatively to permit evaluation of results.

Tumors of Salivary Glands Clinicopathologic Study of 160 Cases is presented by Arnold J Rawson, John M Howard, Henry P Royster and Robert C Horn, Jr [3] (Univ of Pennsylvania) In the 100 cases of mixed tumor gross

(3) Cancer 3 445-458 May 1950

appearance was variable but encapsulation lobulation and a mucoid consistency were noted The common histologic feature was well differentiated, duct like structures No tumor metastasized and only one showed any ability to invade locally In two patients seen only after onset of rapid growth, there was carcinoma with remnants of tissue having features of mixed tumor This suggests that carcinoma develops in 2 per cent of mixed tumors Local recurrence was observed in all sites except lip and pharynx after surgical excision of mixed tumors There was no correlation between recurrence and histologic pattern age at onset, duration of tumor before treatment or tumor size on initial excision. Of 45 patients operated on for mixed tumors of the parotid gland and followed for at least 10 years, local recurrence was observed in 14 The high incidence of local recurrence within one year after operation suggests that many recurrences depend on the growth of residual tumor

Papillary cystadenoma lymphomatosum of the parotid gland was seen in six instances There was a gross intra cystic papillary structure Microscopically papillary projections consisting of dense lymphoid stroma were covered by a well ordered layer of columnar epithelium with eosinophilic granular cells These tumors were benign. There were two additional tumors with the histologic picture of sebaceous glands

There were 17 cases of adenocarcinoma as epidermoid or undifferentiated carcinoma consisting of cords or broad sheets of tumor cells surrounded by varying amounts of fibrous stroma Minor degrees of differentiation were noted, but such features did not alter the course or prognosis. Most of these tumors were in the parotid gland Death occurred within six years after onset in 13 patients The outstanding feature in most cases was extensive local growth and invasion of such structures as the mandible, auditory canal and paranasal sinuses Metastasis to the lung occurred in two patients, to cervical lymph nodes in one and to the brain in one Radical surgical excision was used in two patients, one of whom also had radical neck dissection. Both were apparently well seven years after operation. Most inoperable patients were given x ray treatment although the radioresistance of this tumor was recognized.

Cylindroma occurred in 11 patients The characteristic

Royster[4] (Philadelphia) studied records of 21 patients in whom parotid tumors first occurred before age 16

In two patients, chronic, recurring infection of the parotid and its duct had produced a fibrotic nodular gland, simulating a tumor This disease characteristically has its onset in childhood Exacerbations of acute swelling of the gland occur and are often bilateral If with such a history a patient has a nodule in the parotid, chronic parotitis should be considered and biopsy performed for confirmation if necessary since parotidectomy is often followed by permanent complete facial paralysis, biopsy is preferable initially

Hemangioendotheliomas occurred in five patients Vascular tumors are the characteristic tumor of the parotid gland in the first year of life occasional examples having been noted at birth. The hemangioendothelioma of infancy usually runs a benign course and does not have the ominous implications of the same tumor in adults One tumor in this series was a fibrosarcoma Six were mixed tumors Mixed parotid tumors are considered nonmetastasizing neoplasms. Great variation in appearance and lack of uniform pattern is a common feature Although the mixed tumor characteristically begins in early adulthood it also occurs in childhood. The six patients with mixed tumors were followed for 9-44 years no evidence of malignant change appeared in any of them but four had postoperative recurrence of the tumor

Lipomas occur in the parotid gland but none were found in this series Papillary cystadenoma lymphoma is an encapsulated, usually small tumor which contains many small cysts 1 2 mm. in diameter or larger Its microscopic appearance is characterized by papillary epithelial structures resting on a lymphoid stroma Origin of this tumor is uncertain, but most authors attribute the lesion to an embryonal malformation Most authorities agree that the lesion is benign

Cylindroma, though malignant runs a slow course often 20 years or more It is locally invasive and metastasizes frequently but late to regional lymph nodes and to lungs A moderate amount of mucin is secreted Invasion of nerve sheaths with resultant pain is frequent There was one cylindroma in this series Mucoepidermoid tumors are char

(4) Surg Gynec & Obst 90 20 319 March 1950

acterized by simultaneous occurrence of mucin secretion and epidermoid features in a malignant epithelial neoplasm There were two epidermoid tumors in this series, both of relatively low grade malignancy In two patients neuroblastomas of the cervical sympathetic chain were invading the lower pole of the parotid, and in another an accessory lobe of the parotid gland was mistaken clinically for a parotid tumor

The authors prefer to consider all tumors of childhood malignant until proved otherwise It is suggested that small discrete masses which do not involve the facial nerve be excised in toto for histologic diagnosis With larger lesions, biopsy is preferable

Direct Operative Removal of Benign Mixed Tumors of Anlage Origin in Parotid Region With Summary of Parotid Tumors in General. James Barrett Brown, Frank McDowell and Minot P Fryer[5] (Washington Univ) have used the



Fig 14 —Incision beginning near crus of helix extends down over tragus, under lobe of ear and into neck along a natural crease A flap is raised far forward on the face to expose the entire gland and nerve distribution. Posterior edge may be raised as another flap (Courtesy of Brown J B et al. Surg., Gynec. & Obst. 90 257 268 March, 1950)

direct operative approach to the tumor in 75 patients. There has been no paralysis of the facial nerve and in 10 years no evidence of recurrence All tumors were removed immediately following diagnosis Endotracheal anesthesia was

(5) Surg Gynec. & Obst. 90 257 268 March 1950

usually used. The following technic gave optimal exposure of the area.

TECHNIC.—Incision is planned for maximal exposure and minimal ultimate scar It is started about at the hairline at the crus of

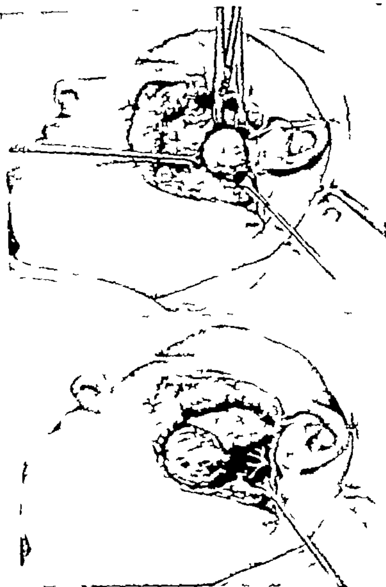


Fig. 15 (top).—Removal of tumor under direct vision of it and of any nerve branches in area. Gentle traction aids in dissection, with careful attention to deep surface where nerve may be adherent.

Fig. 16 (bottom).—Tumor and bed from which it has been removed showing usual position of facial nerve beneath tumor If tumor is under the nerve the same process is used with constant attention to nerve branches and their preservation.

(Courtesy of Brown J B., et al Surg., Gynec. & Obst. 90 237 88 March, 19 0)

the helix continues down in front of the ear, over the tragus, around under the lobe then turns into the neck along a natural fold (Fig

14) The flap is raised just under the skin and held rolled forward by sutures The ear lobe is also elevated out of the field with a suture, and posterior and *inferior flaps may also be raised and sutured* back out of the way

If it is thought that the facial nerve overlies the tumor, the over lying branches may be gently dissected out of the necessary field and the tumor elevated *between them. The main point is that the* nerve must not be damaged. If the nerve is found integrated with a benign tumor, it is preferable to remove the tumor piecemeal and preserve the nerve. Usually, the facial nerve lies under the tumor and a *transverse or vertical incision is made through the superficial* fat and capsule of the parotid directly over the tumor Separation is done with small pointed scissors. The exposed tumor is carefully dissected free from the surrounding gland, gentle traction on the *capsule of the tumor aiding in its delivery Extreme caution should* be used as the lower surface is brought out of the wound because the underlying nerve may be knuckled up by adherence to the gland and subject to damage (Fig. 15) Often the main divisions of the *nerve are in complete view after the tumor is removed, but if they* are not seen further exploration is neither warranted nor desirable (Fig 16)

Hemostasis is maintained throughout the procedure by fine white silk ties. Irrigation of the wound with saline under medium pressure is usually done. Closure is by deep sutures of fine silk or catgut in the subcutaneous layer and by fine black sutures close to the edges of the wound but including full thickness of the skin. A rubber band placed in the depths of wound and brought out at the most dependent portion serves more as an escape valve than as a drain Fine mesh grease gauze is placed over the suture line. A comfortable, firm dressing with surgical waste giving a steady even pressure is the best insurance of primary wound healing

Irradiation of benign mixed tumors seems to have only a temporary retardation effect. The later effect is to make operative removal more difficult. Interstitial radiation alone or combined with operation *is possibly preferable to exter nal radiation*

Technic of Anastomosis of Branches of Facial Nerve with Spinal Accessory for Facial Paralysis is described by Claude C Coleman and James C Walker[6] (Med College of Virginia)

Girl, 14 had complete left facial paralysis after excision of re*current parotid tumor* which had originally been removed five years previously Examination five months after onset of paralysis showed no evidence of return of function, and there was complete reaction of degeneration of the paralyzed facial muscles. The region of the left parotid (Fig 17) was explored. The facial nerve had been de-

(6) Ann Surg. 131:960-968 June 1950

stroyed from a point proximal to the pes anserinus and distally to the level of the anterior border of the parotid Black silk ligatures were placed on each branch of the facial nerve, the spinal accessory and the hypoglossal for later identification At a second operation six days later the spinal accessory was traced under the sternocleidomastoid, and a large branch found entering this muscle was divided as deep in the muscle as possible (Fig 18) The main trunk of the spinal accessory was then divided and the branch separated from the trunk for 2.5 cm. Two other components of the trunk were separated, giving two segments the same length as that of the branch

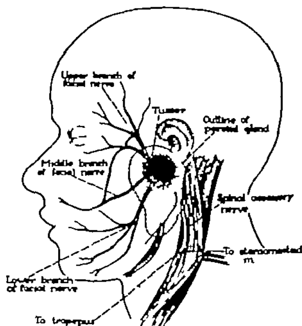


Fig 1 —Stippled area indicates location of parotid tumor involving branches and trunk of facial nerve (Courtesy of Coleman, C. C., and Walker J. C. Ann. Surg 131:960-96 June, 1950)

to the sternocleidomastoid The three branches of the spinal accessory were sutured to the distal branches of the facial nerve with one through-and through arterial silk suture for each nerve. The wound was closed in layers.

Examination six months after operation showed the face well balanced. There were no mass or associated movements and practically no evidence of atrophy around the left shoulder

Since the anatomy of the spinal accessory nerve is inconstant, there may be real disability in some patients after section of the spinal accessory nerve, whereas in others none will result In the latter the spinal accessory nerves divide higher up one branch passing in front of the internal jugular vein to enter and end in the sternocleidomastoid

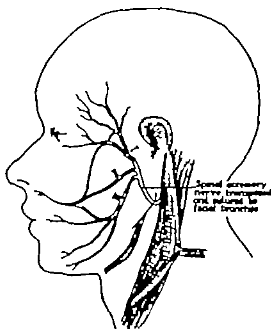


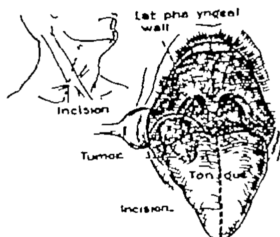
Fig. 18 —Transposition of spinal accessory nerve and suturing to facial branches resulted in restoration of function after facial paralysis. (Courtesy of Coleman, C. C. and Walker, J. C.: Ann. Surg. 131:960-968, June 1950.)

and the other behind the jugular vein to supply the trapezius If only the anterior branch supplying the sternocleidomastoid is divided, there should be no postoperative shoulder trouble

Excision of Mandible for Neoplastic Disease Indications and Technics. In a review of their material, Danely P Slaughter, Erwin H. Roeser and Walter F Smejkal[7] (Chicago) found that only 15 patients were operated on for tumors arising primarily from the mandible whereas 49 had resection of the jaw for tumors arising in adjacent tissues in 35 of these the jaw was secondarily involved and in 14 it was not implicated but was resected to allow surgical approach to intraoral cancer

The present surgical approach to intraoral cancer invading the mandible consists of radical neck dissection on the involved side with removal of the hemimandible and all adjacent involved soft parts in continuity repair is im

(7) Surgery 26 507-522 September 1949

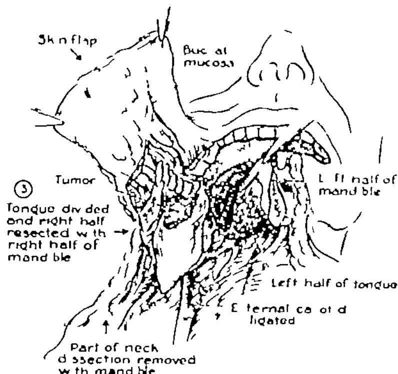


Buccal mucosa

② Skin flap with muscles intact freed from man dible and retracted

① neck dissection

Fig. 19 (top) Fig. 20 (bottom)
(Courtesy of Slaughter D. P., *et al.* Surgery 26 507-522, September 1949)



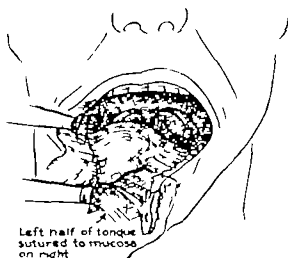


Fig. 21 (top) Fig. 22 (bottom)
(Courtesy of Slaughter D. P. et al Surgery 26 307 322 September 1949.)

mediate and a temporary tracheostomy is performed simultaneously The technic is illustrated in Figures 19 22 In Figure 19 the upper inset shows the skin incision and the lower drawing the intraoral soft parts incisions that can

be utilized in the situation presented Figure 20 shows the first stage of the operation as neck dissection is completed The upper or cheek flap is raised to an exaggerated degree only for anatomic demonstration Figure 21 shows the procedure after section of the mandible and incision through the midline of the tongue Hemiglossectomy is done only if the tongue is involved by the tumor After this stage the mandible is disarticulated or sectioned posteriorly at the required level Figure 22 shows the primary step in closure —suture of the medial cut edge of the intraoral soft parts to the buccal mucosa lining the cheek flap If partial glossectomy has been done as shown, the tip of the tongue should be left free if possible and the tip reconstructed by sutures this will greatly facilitate tongue function and improve the linguals in speaking The skin flaps are approximated with two or more Penrose drains strategically placed Tracheotomy is then performed if it has not already been done

The palliation achieved by radical surgery in advanced intraoral cancer has been an unexpected dividend. It is due chiefly to interruption of the cervical plexus and third division of the fifth cranial nerve plus removal of ulcerating infected and often necrotic cancer in the mouth. Restoration of normal function and symmetry is not as urgent as it might seem The primary repair results in a functional state compatible with maintenance of nutrition and usually allows weight gain and recovery to normal, so that all but two of the surviving patients have refused bone graft restoration An obstacle to immediate attempts at restoration of bone continuity is the hazard of working with irradiated tissues A dental prosthesis is the most practical compromise for patients who have had resection of half the mandible but many of them are content to leave well enough alone and will not bother with a prosthesis

Nonunion of Fractures of Mandible Rainsford Mowlem[8] states that in most fractures clinical evidence of bony union should be obvious in less than two months. Any fracture should be immediately reduced, efficiently maintained and adequately protected against infection

(8) Ann Roy Coll. Surgeons England 5 3-63 Jul 1949

In many fractures of the condyle and neck no fixation is required because the patient can reach and maintain normal dental occlusion. In fracture of the angle and ascending ramus the bulky muscles may be a cause of difficulties or a source of protection. Adequate reduction and splintage of the fracture line is the primary necessity In fracture of the body and symphysis nonunion can most readily occur and the defect must therefore be brought under control at the earliest possible moment The important factors which can convert potential risks into real dangers are delay in fixation, inadequate reduction, inefficient fixation, teeth or tooth remnants in fracture line and gross comminution of the mandible

When a tooth is firm but partially exposed by the line of fracture, it is desirable to exclude it from the fixation *so that it may be removed later if necessary In comminu*tion of the mandible the fracture is usually compound internally and externally Although conservative treatment may achieve union after a long period in a few cases, it appears much more reasonable to accept the fact that nonunion is the probable result, to splint the main mandibular fragments in correct position, to open the fracture area widely, to remove all devitalized bone and to close the defect in the oral mucous membrane

Treatment of nonunion may be expectant or reparative by bone grafting

Technic for Bone Grafting.—Through an incision just below the lower margin of the mandible, access to bone ends is obtained and the periosteum is stripped on the lower margin and buccal aspect. The scar tissue between the fragments is removed without entering the mouth. Dissection is continued up to the alveolar margin of each fragment and then down the lingual aspect anteroposteriorly about ½ in All eburnated bone is cut away from the bone ends and a wedge of the outer aspect of each fragment is removed to create a large vascular surface with which the bone graft can make contact. The mandibular fragments are fixed in correct alinement, and the defect is bridged by the bone graft. This may be a solid graft but more often consists of cancellous chips from the iliac crest. A thin plate of cancellous bone is placed lingually to the bone ends to prevent transmission of movements of the muscles of the floor of the mouth to the cancellous chips. A satisfactory contour is built up, and the chips are retained by suturing subcutaneous tissues over them. The skin is closed as a separate layer The splintage remains in position for four to five weeks. The graft is then tested for *clinical rigidity and, if satisfactory* the splints are discarded.

Congenital Arteriovenous Fistulas in Mandible were encountered in two patients by Richard C Clay and Alfred Blalock[9] (Johns Hopkins Univ) Persistence of embryonic communications between the primordia of arteries and those of veins seems to be the basis of congenital arteriovenous fistulas and probably accounts for multiple openings usually seen, in contrast to the single opening found in traumatic fistula. The head and neck are the commonest sites for persistence of such communications. Congenital arteriovenous fistulas of bone are uncommon and no such lesion in the mandible has been reported previously Surgical repair is advisable to prevent possible complications such as rupture with exsanguinating hemorrhage sudden enlargement with gangrene of the part supplied, cardiac enlargement with failure, increased length of a limb, disfigurement due to a pulsating cirsoid mass or endarteritis with septicemia

When arteriovenous communications in bone are opened by dissection, removal of the entire involved osseous segment may be necessary to control profuse bleeding which comes forcefully from the large vessels which penetrate or lie in the bone In one patient extensive resection of the mandible was required to remove the fistula Postoperatively there was good symmetry and good occlusion without the aid of a prosthesis In the second patient a large tortuous artery was encountered as the external carotid artery was traced upward. Since occlusion of this vessel resulted in obliteration of the thrill and murmur interruption of the abnormal artery was considered preferable to resection of the mandible The artery was excised from its origin on the external carotid to its communication with the cirsoid mass in the mandibular defect A slight thrill and murmur over the fistula was noted three months postoperatively If progressive increase in flow through collateral channels occurs, mandibular resection will be necessary

X ray investigation of the mandible is advisable in any case of congenital arteriovenous communication in the face or neck, whether or not pressure obliterates the thrill If there is evidence of bone erosion, preparation for mandibular resection must be made, since this is the only way to

(9) Surg., Gynec. & Obst. 90 543-546 May 1950

control bleeding and eradicate the fistulas Such preparation should probably include dental impressions to be used, if necessary, in later preparation of a prosthesis.

Anterior (Median) Pharyngotomy The procedure described by Calvin T Klopp and Adrian Delaney[1] (George

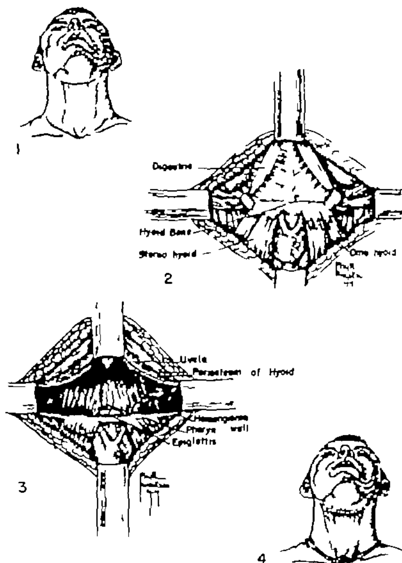


Fig. 23 —Anterior pharyngotomy 1 incision, 2 exposure of hyoid bone 3 pharyngotomy 4, closure of wound. (Courtesy of Klopp, C. T., and Delaney A.: Arch. Surg 60 1161 1170 June 1950)

Washington Univ) is useful for excision of a benign or malignant pharyngeal tumor implantation of interstitial

(1) Arch. Surg 60 1161 1170 June 1950

radium into a nonresectable lesion of the pharynx, as a preliminary step in excision of certain tumors at the base of the tongue or when accurate anatomic diagnosis cannot be established by endoscopy Removal of the primary cancer is combined with removal of regional nodes *en bloc* whenever these nodes are involved by metastases

METHOD.—Local anesthesia may be used or general anesthesia given through a previously constructed low tracheostomy opening or an intratracheal tube. A transverse collar incision is made overlying the hyoid bone (Fig 23, *1*), which extends from the anterior border of the right sternocleidomastoid muscle to that on the left. Skin flaps are undermined 1 cm. above and below the incision, exposing the hyoid bone (*2*) The periosteum is incised 2 cm. on each side, freeing the central portion of the hyoid bone from muscle attachment, and the central segment is excised. The distal ends of the hyoid are retracted laterally and the pharynx entered through a transverse incision in the sulcus created by removal of the central segment of the hyoid. The superior pharyngeal nerve lying just below and the hypoglossal nerve just above the incision are easily visualized The whole posterior pharyngeal wall is now exposed from the level of the arytenoids to the uvula (*3*) For closure the tongue base is approximated to mucous membranes of the anterior surface of the epiglottis with interrupted sutures. This is reinforced by suturing mylohyoid and geniohyoid muscles to the sternohyoid and thyrohyoid muscles. The platysma muscle and skin are approximated. No drainage is used (*4*) If tracheostomy is performed at the original operation, adequate airway is insured at all times Postoperative care includes administration of 300,000 units of penicillin daily for seven days. Oral feedings are not permitted the first 48 hours. A suction machine should be immediately and constantly available to assure patency of the tracheostomy Diet is advanced as rapidly as tolerated. When the patient can withstand corking of the tracheostomy tube for 24 consecutive hours, the tube is removed. Sutures are removed in three to seven days.

Pharyngeal Neurilemmomas of Cranial Nerve Origin Medial Displacement of Internal Carotid Artery as Diagnostic Sign Danely P Slaughter and Frederic A. de Peyster[2] (Chicago) report four cases the tumor arose from the vagus nerve in three and from the hypoglossal in one The patients presented a syndrome not previously described that consisted of (1) a bulging firm submucosal tumor in the posterolateral pharyngeal wall, causing dysphagia and, later, interference with the airway, (2) pulsation of the mass due to medial displacement of the internal carotid artery and (3) interference with function of the involved

(2) Arch. Surg. 59 384-397 September 1949

nerve (two of the patients with vagus tumor had paralysis of the vocal cord on the same side)

In two cases diagnosis was made by aspiration biopsy These lesions are benign encapsulated tumors that are best

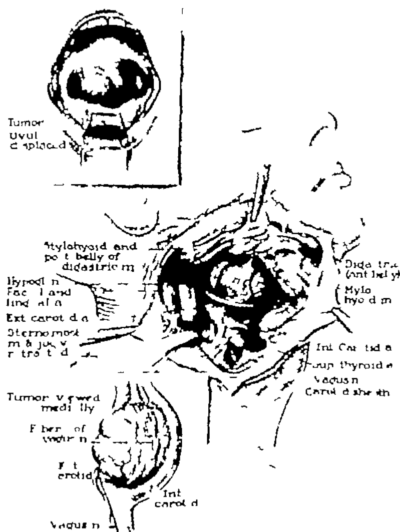


Fig. 24 —Composite and diagrammatic reconstruction of appearance of tumor when exposed through external cervical approach. Upper inset, intraoral view showing bulging mass; lower inset, relation of vagus nerve to tumor (Courtesy of Slaughter D. P., and de Peyster F A. Arch. Surg. 59 386 397 September 1949)

extirpated through an external cervical approach (Fig 24) Irradiation is not only useless but harmful. The principal hazard in excision is hemorrhage, which can be prevented or controlled best by a wide exposure identification and

retraction of vulnerable vessels and their dissection under direct vision The pharyngeal mucosa can be dissected free without penetration, allowing the operation to be done without contamination Actually, dissection of these tumors by the external approach is facilitated by the displacement of important structures by the tumor If completely excised, neurilemmomas do not recur locally, but occasionally they show malignant tendencies

Plasma Cell Tumors of Upper Respiratory Tract Clinicopathologic Study with Emphasis on Criteria for Histologic Diagnosis was made by Arnold J Rawson, Paul W Eyler and Robert C Horn, Jr[3] (Univ of Pennsylvania) Nine plasma cell tumors which had initial manifestations in the upper respiratory or alimentary tracts were compared with nine cases of primary multiple myeloma and numerous miscellaneous inflammatory lesions composed largely of plasma cells In general, the six clinically malignant tumors had characteristics comparable to those of myelomas, whereas the three benign lesions resembled chronic inflammatory processes

In inflammatory lesions, normal plasma cells are distributed throughout the tissue with a definite, but uncharacteristic pattern. They have no especial relation to the stroma. There is no replacement of tissue by plasma cells for they merely lie within other tissues

The absence of certain diagnostic features of malignant plasma cell tumor which makes the presence of malignancy unlikely include (1) orientation of plasma cells in broad sheets on a delicate stroma consisting largely of capillaries, and (2) replacement of other tissues by such plasma cell sheets in contrast to their disposition throughout another tissue All clinically malignant plasma cell tumors in this series showed these characteristics they were not observed in any benign lesion These features are particularly well brought out by silver staining Characteristics which, when present to a significant degree, strongly suggest malignancy include alterations in the nuclear-cytoplasm ratio nuclear characteristics such as large red staining nucleoli and multinucleated cells. Mitotic figures in plasma cells usually indicate malignancy The absence of Russell s bodies is not a

(3) Am. J Path. 26 445-461 May 1950.

reliable criterion of malignancy Absence of group 2 characteristics is not evidence of the benign nature of a plasma cell tumor

Benign plasma cell lesions of the upper respiratory tract may be adequately treated by surgical excision. Malignant plasma cell neoplasms respond well to radiotherapy Malignant lesions treated by surgical removal usually recur

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NECK

Thyroglossal Tract Abnormalities Cysts and Fistulas Report of 105 Cases from Johns Hopkins Hospital Observed during Years 1926 to 1946 is made by Grant E. Ward, James W Hendrick and Robert G Chambers[4] (Baltimore) Thyroglossal cysts and fistulas arise from epithelial rests in the remnants of the thyroglossal duct which are produced by the descent of the thyroid anlage from an evagination in the pharyngeal floor They may be found either in the midline or slightly to one side In this series 60 per cent occurred between birth and age 10 Sex incidence was about equal. There was a cyst in 59 per cent sinus tract in 34 per cent and a palpable subcutaneous duct in 19 per cent

These abnormalities are important because they are often the seat of recurrent inflammatory disease or are a cause of cosmetic disfigurement. The cyst contents are mucoid unless infection causes purulent change It should be remembered that these abnormalities may occur anywhere from the foramen cecum in the base of the tongue to the suprasternal notch and that they are the most frequent cysts occurring in that area. Varying amounts of thyroid tissue may be found in the cystic mass or closely associated with it Branchial fistulas or sinus tracts are easily differentiated because they lie on the side of the neck and not just to the right or left of the midline Either may communicate with the oral cavity but thyroglossal abnormalities do so at the foramen cecum whereas branchial fistulas open at Rosenmüller s pouch in the lateral pharyngeal wall. Visualization of the tract is possible radiologically with lipiodol* instillation

(4) Surg Gynec. & Obst. 89 727 734 December 1949

Treatment of thyroglossal abnormalities is complete excision of all epithelial tissue Incision and drainage should be performed only if the cyst is infected and requires drainage Most of these lesions will eventually become infected and should therefore be removed In this series 51 per cent of patients gave a history of infection at some time in the course Injection of sclerosing solution or x ray therapy are contraindicated

METHOD.—Endotracheal anesthesia should be instituted. A transverse incision 5-8 cm long is made over the cyst or an elliptic transverse incision made around the opening of the sinus or fistula The

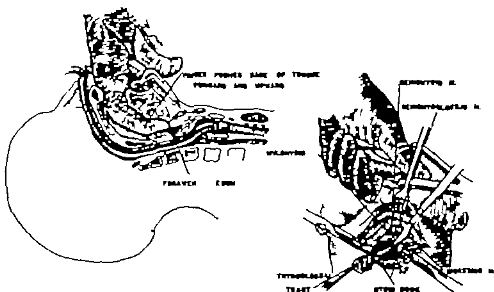


Fig 24—Endotracheal tube in place for removing a cyst or fistula from thyroglossal tract Assistant's finger in the mouth forces base of tongue and foramen cecum forward, facilitating coring out stalk of tract (Modified and redrawn.) (Courtesy of Ward, G. E., et al Surg., Gynec & Obst. 89 727 734 December 1949 from Sistrunk W E. Ann. Surg. 71 1 1 1928)

cyst or fistulous tract is followed to the level of the hyoid bone, the central portion of the bone freed above or below and 1 cm. of the hyoid directly adjacent to the tract removed with a generous block of tissue around the tract. Tension will pull forward the centrally freed portion of bone (Fig 25) An assistant's finger placed in the mouth, exerting pressure against the base of the tongue, forcing it forward, greatly facilitates removal of a core of tissue, including the muscles around the stalk of the tract right up to the foramen cecum. The tract may be followed to the base of the tongue and removed with no untoward effect. A single purse-string suture of fine chromic catgut will close the defect at the foramen cecum, inverting the mucosa into the mouth The musculature of the tongue is brought together in the midline with interrupted sutures of fine silk or chromic catgut. The severed edges of the hyoid bone are brought to-

gether with catgut sutures placed directly through the bone if the patient is young or through the periosteum if the patient is an adult. A small rubber dam drain may be placed deep in the muscle of the tongue to facilitate postoperative drainage, and skin edges are approximated with subcuticular and end-on mattress sutures of fine silk.

None of the 28 suprahyoid lesions recurred after surgery In 34 of 77 which occurred at or below the hyoid, an adequate section of bone was removed 6 per cent recurred. However in 43 no bone was removed and 25 6 per cent recurred

Lateral Lymphoepithelial Cyst of Neck ("Branchial Cyst) E S J King[5] (Melbourne) chose the term lateral lymphoepithelial cyst on the basis of the characteristic histologic appearance observed in 76 cases A few midline cysts have a similar structure but the word lateral differentiates this group from them These cysts show a considerable range of variation in position and structure, so there must be a definite criterion for those which are to be included in the group The criterion is the histologic structure of the wall an epithelial lining with subjacent lymphoid tissue is invariable in some part, if not the whole of the cyst wall.

The cyst commonly lies under the anterior border of the sternocleidomastoid muscle at the level of the bifurcation of the carotid arteries it may project for some distance between these vessels It ranges from a small, firm, even tense unilocular structure to a larger one which may be lax and multilocular The thickness of the wall varies greatly and in part determines the consistency of the structure The internal lining may be smooth but is often irregularly mammillated. Internally there is often some trabeculation The contents vary from a clear fluid containing some cholesterol crystals (rarely mucinous) to a pultaceous semi solid material. Microscopically the cyst is usually lined with squamous epithelium immediately beneath it is lymphoid tissue Often it is impossible to separate the epithelial from the lymphoid cells with certainty In places strands or crypts of epithelial cells penetrate into the lymphoid tissue and appear to merge with it Morphologically this underlying lymphoid stroma is sometimes found to be thymus

(5) Australian & New Zealand J Surg 19 109 121 November 1949

There is a close relation between the cysts and lymph nodes and lymphoid tissue which is of fundamental importance Apart from the occasional protrusion of the deep part of a cyst between the two carotid arteries, there is no constant or even frequent association of the cysts with vessels or nerves Cysts are sometimes associated with the sinuses The following factors all have a bearing on the mode of cyst formation and should be looked for in neck structures, either in the presence or absence of cysts (1) presence of epithelium in lymph nodes, (2) primary squamous cell tumors of lymph nodes, and (3) relation of epithelium to lymphoid tissue

The principal hypotheses of origin of the cysts are that they arise from remnants of a branchial cleft, precervical sinus or thymic duct. There is no real evidence supporting any of these hypotheses, but some deductions may be drawn from the structure of some cysts. In most, epithelium is stratified and mature, however, in a few in which there is cellular variation, the cyst does not appear to arise from preformed epithelium. The single layer of flattened cells merging gradually into a stratified epithelium, its occurrence in sinusoids and its position in the middle of some nodes make an origin from endothelial cells reasonably certain This applies also to the epithelium found in lymph nodes apart from the cysts. The indications therefore are that the epithelium arises from cells which, at the time the cyst is forming, are structurally at least a part of lymphoid tissue In some cases the supporting tissue is thymus in these it may be assumed that the epithelium arises from the cells of Hasall's corpuscles The mode of development of this scattered thymic tissue requires further study The cysts have no direct relation with any of the structures in the early embryo Any terminology suggesting this is misleading and should be discarded.

Branchiogenic Anomalies Results of 70 Cases Observed at Johns Hopkins Hospital between 1926 and 1946 are reported by Grant E. Ward, James W Hendrick and Robert G Chambers[6] (Baltimore) Branchiogenic cysts and fistulas may occur at any age and in patients of any race or either sex.

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(6) West. J Surg 57:536-549 November 1949

Bilateral fistulas are common in the region between the supra auricular area and the angle of the jaw Fistulas are usually present from birth and most have their external orifices situated along the anterior border of the sternocleidomastoid muscle in the lower third of the neck Symptoms are usually an annoying continuous or intermittent discharge of mucus and recurrent attacks of inflammation

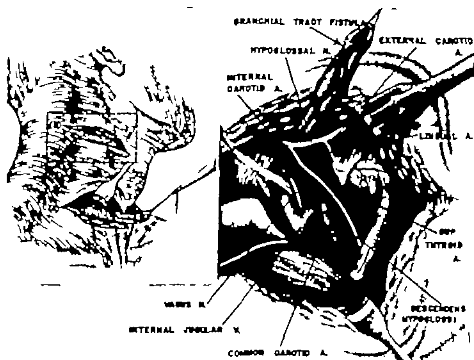


Fig. 26 —Insert redrawn to show step ladder incision in neck for removal of branchiogenic fistula. Incision *B* of insert is enlarged to show dissection of branchial tract fistula to pharyngeal wall. (Courtesy of Ward G. E., *et al* West. J Surg 57 536-549 November 1949; from Bailey H Brit. J Surg 21 178 October 1933)

in the fistula with periodic obstruction Fistulas may occur below the level of the hyoid. The tract can be easily visualized radiologically after injecting it with lipiodol.[8] Complete surgical excision of the fistulous tract is the most rational therapy

METHOD.—An elliptic transverse incision is made about the external orifice after a purse-string suture has been placed about it. Gentle traction is applied and the tract is followed up beneath the skin, platysma muscle and fascia with dissecting scissors, and a second transverse incision made over the tract on a higher level (Fig 26) The tract is then threaded through the first to the second incision and the dissection begun anew and continued until the tract

has been completely removed. If the tract extends to the pharynx, one finger is placed in the mouth and pressure applied over the pharyngeal wall opposite the tract entrance facilitating dissection into the pharynx (Fig 27) If possible, the entire internal orifice should be invaginated into the pharynx by a purse-string suture and the wounds closed in the usual manner A drain may be placed in the lower wound for two or three days.

Branchiogenic cysts usually occur at the angle of the aw but may be seen at any location from in front of the xternal auditory canal to the clavicle An insidious, pain ss and at first inconspicuous swelling develops The lining

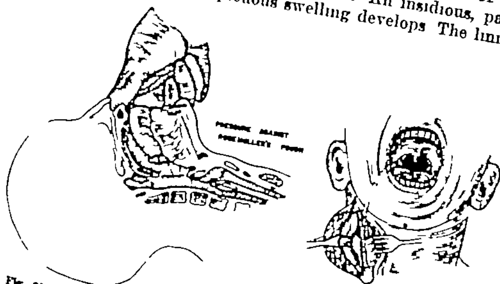


Fig. 27 —Assistant's finger placed in the mouth produces pressure over the lateral pharyngeal wall assisting dissection of branchiogenic fistula. (Courtesy of Ward, G. E. et al West. J Surg. 5 536-549 November 1949)

epithelium may be either squamous or stratified columnar The latter type may possess cilia and usually does after repeated infection. Aspiration of a previously uninfected cyst yields thick, transparent mucoid fluid with the odor of sebaceum, signifying that columnar epithelium lines the cyst An opaque watery or milky fluid indicates that the cyst is lined with squamous epithelium It is from these characteristics that diagnosis can often be made Branchial cleft cysts should be treated by complete extirpation of all epithelium bearing tissues

Method —The best approach is through an incision over the most prominent part of the cyst but parallel to the anterior border of the sternocleidomastoid muscle Since the cyst may have deep attachments adequate exposure is necessary Rupture should be

avoided, especially in the superior medial border in which the cyst is deepest, for if any epithelium is left it will cause recurrence. Any incomplete fistulous tract which may extend to the pharynx must also be removed.

Branchiogenic carcinoma may develop from a previous cyst It usually presents a picture of squamous cell carcinoma In this series there were seven cases in which it was located between the angle of the jaw and the level of the thyroid cartilage In six cases the patients were over age 50 The best treatment is radical surgical excision with radical neck dissection of regional lymph nodes The magnitude of the procedure depends on the extent of the growth. Resection of the common carotid artery should be approached with caution, because cerebral complications from ligation or resection of the vessel occurs in 12-25 per cent of cases, depending on the patient's age, and may vary from psychoses to death

Facial Distortion in Wryneck Prevented by Early Resection of Fibrosed Sternocleidomastoid Muscle James Barrett Brown, Frank McDowell and Minot P Fryer[7] (Washington Univ) state that wryneck (torticollis) probably results *from injury to the sternocleidomastoid muscle during* delivery especially if there is a breech presentation. Stretching tearing and possibly necrosis of muscle fibers occur with dense fibrous tissue replacement

The contracted muscle pulls the head over to the involved side making the ear close to the shoulder, twists the chin around to the other side and tilts it upward. The mass may be palpable Before treatment, observation should extend over six months to determine whether there will be spontaneous recovery or damaging increase in deformity Excision of the whole fibrosed muscle will relieve the deformity without producing too noticeable an irregularity of the contour of the neck. If operation is delayed until childhood, it can still be done with hope of obtaining an excellent result

PROCEDURE.—Open ether anesthesia is used in babies and intra*tracheal anesthesia in older children* A short collar incision 5 cm. long is made just above the clavicle over the mass. The platysma is opened and the external jugular divided if necessary The sternocleidomastoid mass is exposed by dissection under a skin and platysma muscle flap *to allow retraction over the length of the con*

(7) Plast & Reconstruct. Surg 5 301-309 April 1950

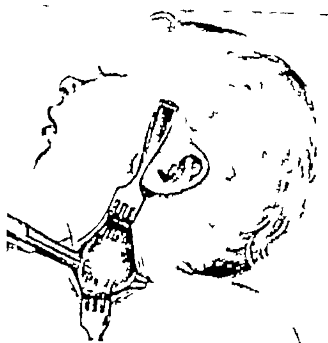




Fig. 28 (top) —In surgery for wryneck, muscle is carefully separated from jugular vein, carotid artery and vagus nerve

Fig. 29 (bottom) —Elevation and removal of fibrosed muscle

(Courtesy of Brown J B., *et al* Plast. & Reconstruct Surg 5 301 309 April, 1950)

tracted muscle Dissection is carried carefully around the muscle anteriorly and under it to avoid the internal jugular vein carotid artery and vagus nerve (Fig 28) Both heads of the muscle may be divided from the clavicle if necessary The muscle is gently elevated and separation carried upward underneath it, avoiding the deep

structures and saving the eleventh nerve (Fig 29) The branch to the sternocleidomastoid muscle may be cut. The twelfth nerve is avoided as the dissection is carried up and the muscle is detached close to the mastoid In older patients, structures in the cervical fascia, scaleni or trapezius muscles may be shortened secondarily and must be freed so that the head can be moved to any position. If only one head of the sternocleidomastoid muscle seems to be involved the operation may be limited to this site, but secondary procedures may be required The wound is closed with fine sutures in the platysma muscle and skin. A small rubber drain may be left in. A pressure fixation dressing of mechanics waste and elastic adhesive is applied, casts, braces or other appliances are not necessary The child s activities provide the best physical therapy Further treatment is not necessary although follow up should be carried out.

Costoclavicular Compression Relation to Scalenus Anticus and Cervical Rib Syndromes Compression of the subclavian artery and brachial plexus nerve trunks may occur at *one of three places behind the scalenus anticus muscle,* between clavicle and first rib and beneath the pectoralis minor muscle These three conditions are diagnosed by three separate maneuvers the Adson maneuver shoulder attention position and hyperabduction of the arm John M McGowan (Tufts College) and Morris Velinsky[8] (Kilgore Tex) show that many symptoms attributed to the scalenus anticus muscle are actually due to costoclavicular compression The neurovascular structures passing to the arm are intermittently compressed as in a vise the jaws of which are the clavicle and the cervical or first rib This compression is readily produced by a test in which the pulse to the arm is greatly reduced or shut off when the shoulders are placed in the soldiers' attention position

With the Adson maneuver presence of the scalenus anticus syndrome is implied if systolic pressure, recorded *first with the shoulder placed forward and upward shows a reduction of 20 points or more* when the head turned to the side being studied is thrown back and a deep breath taken Many patients when tested for scalenus anticus syndrome by the Adson maneuver automatically push the shoulder down and back, occluding the pulse by costoclavicular compression, thus suggesting a scalenus anticus syndrome Section of the muscle may give some benefit because of increase in size of the costoclavicular space

(8) A J Surg 9 62 73 July 1940

but the erroneous diagnosis may account for some of the disappointing results reported

Of 21 patients who complained of vascular and neurologic disturbances of the arm, 14 had a costoclavicular compression syndrome In all, the pulse was reduced in volume or completely occluded when the shoulders were placed in the attention position Of 108 presumably normal controls, only 4 had positive reactions to tests and 3 of these had the costoclavicular syndrome Only one patient who was symptom free gave a positive reaction, which indicates that the test is over 99 per cent accurate

Among the 14 patients with costoclavicular compression syndrome, there was a specifically positive reaction to the Adson maneuver in only 5 This indicates that in these five there was fibrosis of the scalenus anticus, probably from intermittent pinching of the muscle between clavicle and first rib

Some patients were benefited by exercises aimed at strengthening the levator scapulae and trapezius muscles, although follow up was not adequate If exercises fail, scaleniotomy and removal of the cervical rib or a portion of the first thoracic rib is recommended Excision of the middle third of the clavicle is another possibility in intractable cases, but it has not been tried

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THYROID—PARATHYROID

Pathogenesis of Hyperthyroidism. Peter Heinbecker[9] (Washington Univ) states that hyperthyroidism results from excess hormone production either by localized thyroid acinar cells in an adenoma or by overactivity of the acinar cells of the whole thyroid gland This overactivity is caused by increased amounts of thyrotrophic hormone Increased production of this hormone which is secreted by the basophil cells of the glandular hypophysis, results from an increased secretion of the neurohypophysis which is under control of fibers from the supraoptic and paraventricular hypothalamic nuclei The hypothalamus, including these two nuclei and the

(9) Ann. Surg. 130 804-82 October 1949

autonomic nervous system centers, is subject to excitation and suppression from the central nervous system As a consequence of exteroceptive and interoceptive impulses which reach the central nervous system, the neurohypophysis may be influenced Persons differ constitutionally with respect to the degree to which this chain of events activates the hypophysis The action as such is normal for regulation of visceral functions This concept is based on experimental data as well as on clinical observations

Rate of Conversion of Administered Inorganic Radioactive Iodine into Protein Bound Iodine of Plasma as Aid in Evaluation of Thyroid Function. *Dwight E Clark, Robert H. Moe and Evelyn E Adams*[1] (Univ of Chicago) gave I^{131} orally to patients with varying degrees of thyroid function Those who were thought to have normal or a low thyroid activity received 0 5 1 5 mc. Those who had an elevated basal metabolic rate and presented the classic clinical picture of hyperthyroidism were given a large tracer dose or a therapeutic amount of radioactive iodine the latter dose varying from 3 to 8 mc according to the estimated size of the gland No patient was fasted or on a special diet Many of the patients were studied in the outpatient department. Blood for determination of the total amount of radioactive iodine in a given amount of plasma and the percentage of this which was protein bound was drawn in exactly 24 hours Results were expressed as the ratio of radioactivity in counts per second in the protein fraction to total plasma radioactivity in counts per second This was designated the conversion ratio which was determined as soon as possible after the basal metabolism test was obtained.

Twenty-eight patients with hyperthyroidism were studied. Conversion ratio ranged from 45 to 96 per cent (average, 78 5) Only one patient showed a turnover of less than 50 per cent he had discontinued propylthiouracil two weeks before the test and had minimal signs of recurrence if four weeks had been allowed to elapse before determining the conversion ratio he would probably have had a ratio above 50 per cent. There seemed to be a relative correlation between severity of hyperthyroidism and conversion ratio There was no overlapping between the upper limit of normal and hyper

(1) Surgery 26 331 340 September 1949

thyroidism At present, all patients with a conversion ratio of 50 per cent or higher are considered to have hyperthyroidism.

Twenty two euthyroid patients were studied 16 had diseases unrelated to the thyroid 3, benign adenoma, 2, carcinoma of the thyroid treated by partial thyroidectomy, and 1, severe malignant exophthalmos but no thyrotoxicosis. Range of conversion ratio was 13-42 per cent (average, 24)

The expected low conversion ratio in hypothyroidism or myxedema was confirmed in 19 cases the range was from 2 7 to 12 5 per cent (average, 6) Patients who convert less than 10 per cent are considered to have abnormally low thyroid activity

In seven patients who had hypertensive cardiovascular disease with elevated basal metabolic rate, the conversion ratio was under 10 per cent, placing them in the hypothyroid range This would suggest that the body had suppressed the action of the thyroid to decrease metabolic activity and thus reduce work of the heart. Two patients with essential hyper tension converted 36 and 23 8 per cent, placing them in the euthyroid group

Histologic Localization of Absorbed Radioactive Iodine in Some Human Thyroid Diseases is reported by Frederick L Kreutzer, Earl R Miller Mayo H. Soley and Stuart Lindsay[2] (Univ of California) A tracer dose of I^{131} was administered to patients with various thyroid diseases. One to five days later operation was performed and uptake of iodine in removed tissues determined by Geiger counter and by radioautography

In 13 patients with nodular goiter the microscopic picture varied from frank hyperplasia to marked involution of nodules. Measurement disclosed that the greater the hyperplasia the greater the uptake of iodine Total uptake of the involuted gland was about 20 per cent of the administered dose while in the hyperplastic gland uptake ranged from 40 to 60 per cent. With intervals of three days or less from ingestion to operation most of the iodine appears in the cells but with longer intervals appreciable quantities appear in the colloid Small uptakes were noted in one simple and one fetal adenoma.

(2) Arch. Surg. 60 707 720 April, 1950.

In four cases of thyroiditis total uptake was less than 9 per cent of the administered dose Radioautographs showed uptake largely confined to whatever groups of normal-appearing cells remained. Areas of lymphocytic infiltration and disorganized acinar structure had no demonstrable uptake

There was little evidence of radioiodine uptake in either metastatic or primary sites in 14 of 15 cases of thyroid carcinoma The exception was in a patient with well differentiated thyroid carcinoma and pulmonary metastasis of 20 years' duration Uptake was substantial in tissue from the primary tumor and from an area of lymph node metastasis in the neck These findings suggest that radioiodine will probably be of limited value as the sole therapeutic agent for treating carcinoma of the thyroid

Benign and Malignant Epithelial Tumors of Thyroid Gland were studied by Leo M. Zimmerman, David H Wagner, Harold M. Perlmutter and George D Amromin[4] (Michael Reese Hosp) Of 1 871 thyroid glands *surgically removed* 102 contained true benign tumors or adenomas and 52 *malignant tumors*

Only two types of adenomas were recognized the papilliferous which comprised 70 per cent and the simple which comprised 30 per cent The papilliferous adenoma consists of cuboidal or columnar cells with clear or eosinophilic cytoplasm arranged on a stalklike structure of fibrous tissue with a vascular core The simple adenoma includes all those composed of either cords of eosinophilic cells or masses of very small acinar structures which are devoid of colloid. The term fetal adenoma was abandoned as misleading Delineation by a capsule was not necessary for classification as an adenoma. All nodules containing colloid filled acini were excluded from *the category of adenoma these tumors represented 5 4 per* cent of the specimens studied In most cases, adenoma was found incidentally in *glands removed for other indications.* About three-quarters were 1 cm. or smaller in diameter

Most malignant tumors were entirely unsuspected before operation Of 38 patients followed 23 were alive and well 1 13 years postoperatively 6 were living up to 6 years but had metastases, and 9 were dead 6 from carcinoma of the thyroid

(4) Arch. Surg 60 1183 1198 June 1950

Of patients with carcinoma survival rate was highest in the 23 with papillary adenocarcinoma Of 21 patients followed, 12 were well 3-13 years postoperatively and 3 were dead. Only three of six patients with adenocarcinoma were well one to three years postoperatively, another was living with metastases and the other two were dead. Results in patients with carcinoma simplex or undifferentiated carcinomas were even less satisfactory

The term malignant adenoma is applied to tumors with insufficient positive evidence for diagnosis of malignancy In most of these lesions there is some proliferative activity with mitotic figures and cellular pleomorphism, but no evidence of blood vessel or capsular invasion Of six patients with this disease four were well one to five years postoperatively one was living with metastasis two years after operation and one had died of carcinoma of the thyroid within six months.

Blood vessel invasion was found in 19 of 52 cases of carcinoma Survival for five years or more occurred in 26 per cent of these whereas 27 per cent of 33 patients without blood vessel invasion lived for a similar length of time Apparently, blood vessel invasion is not necessarily a dire prognostic sign

All nodular goiters which produce symptoms either of thyrotoxicosis or of compression should be removed. Nodular masses showing evidence of increasing size or firm consistency are also excised. Fixation of the thyroid mass indicates carcinoma unless inflammation can be demonstrated as the cause Papillary carcinoma may be treated with partial or subtotal thyroidectomy, if local recurrences develop reoperation is still possible with considerable promise of success Radical neck dissection is done if local metastatic lymph node involvement is present at reoperation X ray therapy may be used postoperatively Nonpapillary types of thyroid cancers are treated by hemi or total thyroidectomy with radical dissection of one or both sides of the neck in selected cases. Postoperative irradiation is probably advisable

What Thyroid Nodules Are To Be Feared? In trying to answer this question Oliver Cope Brown M. Dobyns, Edward Hamlin Jr and James Hopkirk[5] (Massachusetts Gen'l Hosp) analyzed carcinomas of the thyroid seen during 1937 48 with results shown in Tables 1 and 2 Starting in 1944

(5) J Clin. Endocrinol. 9 101 1022 October 1949

every patient with a single nodule or unilateral abnormality of a single area of the thyroid was operated on for removal of the nodule or localized abnormality, even if it was believed benign In 156 patients, incidence of malignancy was 19 per cent. The low reported incidence of carcinoma in nodular goiter in autopsy statistics is due to the small number of patients with such disease who die in the hospital.

Despite accurate physical and laboratory examinations, satisfactory diagnosis of thyroid lumps often cannot be made

TABLE 1—Carcinomas Encountered 1937-48

Type	No.	Av Age of Patient	Age Range
Papillary	62	46	16-76
Alveolar	24	48	17-62
Undifferentiated	27	58	32-80
Epidermoid	2	62	56-67
Lymphoma	1	65	
Retic. cell sarcoma	2	65	55-76
Metastatic	12	56	39 74
Total	130		

TABLE 2—Origin of Carcinomas Metastatic to Thyroid

Rectum	2
Thyroglossal duct	2
Lung	1
Esophagus	2
Kidney	2
Larynx	3
Total	12

without exposure and even biopsy At times, definitive clues may be obtained from the delphian node lying in the midline of the neck just above the upper border of the thyroid isthmus and in front of the middle cricothyroid ligament It is normally not palpable When carcinoma is present the gland may be palpable At operation the gland is sought removed and opened if carcinoma is found, radical operation is undertaken without cutting into the primary lesion in the thyroid gland. Diagnosis may also be helped by the finding that, after administration of radioiodine, solitary nodules which emanate more activity than surrounding tissue are likely not to be malignant, whereas those with less activity may harbor carcinoma.

Carcinoma of Thyroid in Children Ten Year Follow up Hugh F Hare and Richard V Newcomb[6] (Lahey Clinic) review five cases of thyroid cancer in children, aged 6-13, who have been followed for 13-18 years. They have seen only 12 cases of this disease in children.

The five patients have shown a few points in common, the most important being the long survival time, a finding also reported by other writers Also important was the fact that many years after removal of the primary tumor pulmonary metastases of similar appearance developed in two patients Histologic study of the tumors showed no startling consistency In one case considerable variation in the type of malignant cell was found at different examinations and at different times In one specimen three malignant cell types were identified. Adenocarcinoma was the most common variety of malignant growth and occurred in some form in four of the five cases

The two patients with metastases to the lungs had different pathologic pictures. The fact that cancer arose in lateral aberrant thyroid tissue in both may be of some significance. In two patients, after the original tumor had apparently been cured, multiple colloid adenomatous goiters developed, possibly on a compensatory basis.

Radiation therapy is indicated as an adjuvant to operation in treatment of all carcinomas of the thyroid In three of the four patients in whom it was used regression of the recurrent or metastatic lesion occurred. Any nodular mass in the region of the thyroid in children should be suspected of being malignant until proved benign by excision and biopsy Distant metastases in carcinoma of the thyroid do not necessarily portend an unhappy outcome

Carcinoma of Thyroid Contributions to Its Clinical Picture, Histopathology, Treatment and Prognosis Arne Bertelsen, Erik Christensen and Viggo Eskelund[7] (Copenhagen) analyzed experience with 92 females and 26 males, most of whom were aged 40-80 Symptoms such as rapid growth, changed rate of growth, pain, fixation, hoarseness or Horner's syndrome indicate a grave prognosis, for all are characteristic of late stages of carcinoma of the thyroid. Weight loss

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(6) Radiology 54 401-406 March, 1950
(7) Acta chir Scandinav 99 05 224 1949

is not rare and when found in cases of nontoxic goiter should suggest malignancy

Histologic examination was made in 96 cases, and in 72 the material was reviewed. Metastases to lymph nodes were found in 70 per cent to viscera in 36 *per cent and to bones in 18* per cent. The carcinomas were classified as adenoma with invasive growth, 6.9 per cent adenocarcinoma of papillary or alveolar *type 43 per cent carcinoma simplex of small cell or* giant cell type 37 5 per cent and miscellaneous tumors such as spindle cell carcinoma or fibrosarcoma 12 6 per cent

Follow up was possible in 116 cases The tumor was regarded as inoperable in 55 Total hemithyroidectomy was performed in 6 and subtotal thyroidectomy, enucleation and re*section in 55 The five year survival* rate was *29* per cent and the 10 year rate 21 per cent Reports in the American literature indicate a 5 year survival rate of 50-62 per cent and a 10 year rate of 43 per cent *This difference* is attributed to the European attitude that nontoxic adenomas should not be treated surgically and to the infrequent use of total thyroidectomy with neck dissection in cases of carcinoma of the thyroid

Carcinoma of Thyroid Gland. Grant E Ward J W Hendrick and Robert G Chambers[8] (Johns Hopkins Hosp) reviewed 112 consecutive cases and found that the disease may occur at any age and is one of the more frequent cancers of the neck in children. There were 74 female and 38 male 82 white and 30 Negro patients It is conservatively estimated that from 4 to 20 per cent of discrete adenomas develop into cancer irrespective of age however the younger the patient the greater is the danger of malignant transformation In 87 patients (77 per cent) thyroid abnormality preceded the symptoms of cancer 20 had an aberrant position of the apparent initial tumor indicating that the corresponding lobe of the thyroid was involved by a low grade cancer Hyperthyroidism symptoms were present in 30 (26 per cent) but only 24 (21 per cent) also had a basal metabolic rate above +15

The cases included 61 low grade malignancies (36 adenomas with blood vessel invasion and 25 papillary cystadenomas) 37 moderate grade malignancies (20 papillary adenocarcinomas, 11 alveolar adenocarcinomas and 6 Hürthle cell carci

(8) Ann. Surg. 131 473-493 April, 1950



Fig. 30.—Lymphatic drainage of thyroid gland. (Courtesy of Ward G. E., et al.; Ann. Surg. 131:473 493 April, 1950; after Rouvière H.: Anatomy of Human Lymphatic System [Ann Arbor Mich.: Edwards Bros., Inc., 1938].)

nomas) and 14 high grade malignancies (5 small cell carcinomas, 1 giant cell carcinoma, 3 epidermoid carcinomas, 4 fibrosarcomas and 1 angiosarcoma)

The lymphatic system of the thyroid begins as a rich, delicate network of lymphatic channels around the follicles, extending peripherally through the gland into collecting trunks which drain into six groups of nodes The multiplicity of directions of lymphatic flow from the various parts of the gland account for the extensiveness of node metastases. If possible

the area of the gland that is primarily involved should be determined to evaluate the probable extension of metastases (Fig 30) Metastases may develop via the blood stream or the lymphatic channels from malignant adenoma The regional nodes were involved in 17 of the 20 cases of papillary adenocarcinoma (85 per cent) and, together with distant nodes in many instances, in 39 cases of the entire series (34 8 per cent) All metastases from malignant adenoma and papillary adenocarcinoma were limited to one side of the neck.

Surgical eradication of every adenoma is mandatory When frozen section reveals evidence of malignancy, the authors' policy is to do a hemithyroidectomy with preservation of the recurrent laryngeal nerve and radical neck dissection extending up to the digastric muscle The operative technic is essentially that developed by Lahey

Technic.—The usual collar incision is made and elongated up the involved side of the neck to the mastoid process. The skin flaps and platysma muscle are dissected widely The sternocleidomastoid muscle is severed above the clavicle and below the mastoid process to give access to the internal jugular vein, which is then ligated above the clavicle and below the mastoid process. The omohyoid muscle is severed and, since thyroid cancer invades blood vessels, the jugular vein and its tributaries from the thyroid gland, together with the fascia containing lymph nodes, are rolled medially to the lateral border of the thyroid gland. The recurrent laryngeal nerve is dissected out, the superior and inferior thyroid arteries ligated, and the strap muscles severed from their upper and lower attachments. The thyroid lobe and isthmus are removed. To prevent the possibility of postoperative edema, swelling or hematoma, all involved tissue adherent to the trachea must be removed leaving the trachea bare.

Lesions that have extended from the lower pole of the thyroid to infiltrate the structures in the superior mediastinum are not removed surgically Tracheostomy is performed at completion of the operation. Irradiation is begun about 10 days or 2 weeks later It is also given in inoperable cases and for local recurrences. It has been of definite value in reducing the size of the parent lesion and holding regional metastases in abeyance Local recurrence in the regional nodes only is treated by surgical excision and postoperative radiation. Experimental work is being conducted on radioactive iodine

Prognosis will be improved by routine removal of the benign thyroid adenoma which is the precursor of cancer in

80 per cent of cases. A good prognosis is encountered in cases developing from discrete or multiple adenomas.

Cancer of Thyroid Ten 20 Year Follow up of 198 cases is presented by Hugh F Hare and Ferdinand A. Salzman[9] (Lahey Clinic) The clinical findings of early cancer are so strikingly similar to those of single adenomas and thyroiditis that biopsy and histologic evaluation are necessary for differentiation. In this series single thyroid nodules were malignant in 10 per cent of patients on whom operation was done This incidence is high enough to warrant removal of all single tumors. Associated hyperthyroidism was noted in 16 patients with cancer This finding may be significant since all these tumors were diagnosed before the days of radioactive iodine. Because of the recent finding of several cancers in patients with hyperthyroidism who were treated with radioactive iodine or radiation, some investigators are afraid to use these substances.

There were 49 cases of alveolar adenomas with invasion. All tumors were removed surgically and most of the patients received postoperative x ray therapy The 10 year survival rate was 38 7 per cent and the 20 year rate 10.2 per cent

Papillary adenocystoma with invasion was encountered in 48 patients and papillary adenocarcinoma in 38 The 10 year survival rates were 47 9 and 52 6 per cent and the 20 year rates 4.1 and 10 5 per cent respectively These tumors should be removed surgically and if there is lymph node involvement radical neck dissection should be carried out. If there has been invasion of the trachea and muscles, x ray treatment should be used postoperatively Metastases may be inhibited for many years by x ray therapy even though the tumor does not entirely disappear The tumors thus far described are those most likely to respond to radioactive iodine

Of 24 patients with alveolar adenocarcinoma 20.8 per cent survived 10 years and none survived 20 years These tumors did not respond to irradiation in the same fashion.

The alveolar tumor if it accepts radioactive iodine may be curable, but it probably contains enough anaplastic cells which will not accept radioactive iodine to make it advisable to use x ray therapy and in some cases radium in addition

9) Am. J Roentgenol. 63 881-888 June 1950.

Crile Jr., and William S Dempsey[2] (Cleveland Clinic) Twenty three were found in thyroids removed because of hyperthyroidism, 19 of the glands were hyperplastic. Two were discovered incidentally at autopsy Follow up studies were possible on 17 patients, all of whom were without recurrence for periods of five years or more after operation.



Fig 32 —Small cuboidal cells in acinar and papillary arrangement, infiltrating thyroid capsule, reduced from × 70 (Courtesy of Hazard, J B, et al. J Clin. Endocrinol. 9 1216 1231 November 1949)

Grossly the capsular surfaces of the thyroid lobes were smooth and of the usual color or, when the lesion adjoined the capsule, there was an indefinite small pale patch. Sections revealed a small, firm or hard, white, yellowish or gray circumscribed but not encapsulated lesion (Fig 31), which varied from 2 to 20 mm in diameter Microscopically all but one of the tumors was papillary with acinar elements of variable size. The epithelial cells were columnar or cuboidal and of

(2) J Clin. Endocrinol. 9 1216 1231 November 1949

small or medium size (Fig 32) They resembled the usual cell type found in papillary carcinomas which metastasize to the lateral cervical region. The thyroid tissue adjoining the tumor was invaded slightly in 18 cases and moderately in 1 The most characteristic low power configuration was that of an irregular rounded papillary tumor with abundant fibrous stroma marginated by thyroid lobules arranged so as to pro duce a scalloped appearance and separated by irradiating bands of stroma continuous with that of the neoplasm In about two thirds of the cases the capsule adjoined the tumor and in 11 was microscopically infiltrated, although there was never extension into the tissues adjoining the thyroid

It is important that the innocence of nonencapsulated scle rosing tumor of the thyroid be recognized and appreciated Although the genesis of these benign tumors is unknown, pa tients having them should not be subjected to radical opera tion or x ray therapy

Intrathoracic Goiter Its Incidence, Symptomatology and Roentgen Diagnosis In 6½ years, among 908 thyroidec tomies performed at Massachusetts General Hospital, James J McCort[3] found 28 intrathoracic goiters (3 1 per cent) 20 of which were partially and 8 completely within the thorax. Only those whose major portion lay within the thorax were considered intrathoracic all extended to or beyond the aortic arch. Ages of the 28 patients (14 men and 14 women) ranged from 35 to 75, only 3 were under 40 and 20 (71 per cent) were over 50 Twenty four goiters were nontoxic and nodular, three were nodular with a mild degree of hyperactivity and one showed carcinoma. There were no instances of toxic dif fuse hyperplasia with exophthalmos The most constant com plaints, in order of frequency were swelling of the neck dyspnea on exertion, cough dysphagia, dyspnea on lying down, choking sensation and hoarseness, four patients were asymptomatic. On physical examination, the commonest and most important finding was palpable enlargement of the thy roid, which was present in all patients in whom intrathoracic extension was partial Deviation of the trachea and dilatation of the neck veins were not often noted One patient had a plunging goiter and one vocal cord paralysis. All goiters were located in the superior mediastinum, 19 were anterolateral to

(3) Radiology 53 227 237 August, 1949

the trachea, 6 behind the trachea and 3 behind the esophagus.

The significant roentgen findings were displacement of the trachea by the mass in 27 cases, displacement of the trachea beginning high in the neck, frequently at the larynx and with some tilting of the latter, compression of the trachea, *often* present but not in severe degree, displacement or compression of the esophagus accompanying similar changes in the trachea, upward motion of the goiter with swallowing in 84 per cent of the patients examined, calcification within the goiter in 25 per cent, a smooth or only slightly nodular outline of the tumor, reflection of the mediastinal pleura below the goiter

The only satisfactory treatment is surgical removal. This is indicated because 7.2 per cent of nodular goiters are said to be malignant, sudden tracheal compression (from hemorrhage into the gland or sudden and rapid growth of the gland) may result in asphyxiation, and interference with venous return from the head may result in syncope Complete surgical removal was accomplished without complication in all cases. There is no indication for deep roentgen therapy of intrathoracic goiter

[*There can be no doubt* about the wisdom of surgical removal of intrathoracic goiters. There may not be complete agreement about the best approach. The smaller ones can be satisfactorily removed through the usual collar incision. But for the very large ones our preference is to use a sternum-splitting incision.—Ed.]

Tumors of Parathyroid Review of 23 Cases is presented by Boyd K. Black and Lauren V Ackerman[4] (Washington Univ) Most patients were in the fourth decade. The adenomas appeared approximately one decade earlier and about three times more often in men than in women. Hyperparathyroidism should be suspected when there are (1) renal stones without evidence of the usual causes (2) recurrence of renal stones (3) renal stones in the parenchyma (4) nephrocalcinosis, (5) multiple bone lesions (6) a single cystic bone lesion, *particularly* in the maxilla or mandible (7) multiple spontaneous fractures and (8) diagnostic problems, especially in patients with nausea and vomiting weakness and anorexia. The adenomas in this series were composed of any one or a combination of chief wasserhelle oxyphil and transitional cells. Cells may be arranged in strands or sheets

(4) Cancer 3 415-444 May 1950.

or show papillary, acinous or perithelial formation. Parathyroid adenomas usually occur singly, but in rare instances two have occurred simultaneously

Kidney and bone lesions are common complications of hyperparathyroidism In this series three patients had symptoms related to kidney stones alone, three kidney stones and bone changes, one a history of stones and five asymptomatic stones. Renal stones usually persist after removal of a parathyroid tumor The degree of renal damage before removal of the parathyroid adenoma is the most important determining factor in the ultimate prognosis After removal of the adenoma, every effort, including removal of renal stones, should be made to protect and improve kidney function. Nine of the 12 patients with kidney lesions died 6 of renal insufficiency

Bone changes were the primary symptom in 17 patients. The lesions ranged from slight, diffuse osteoporosis to multiple bone cysts and fractures. In two patients there were peptic ulcers associated with parathyroid adenoma. In two others there was the rare combination of parathyroid adenoma complicated by long-standing secondary nephrocalcinosis, with profound impairment of kidney function and resultant secondary hyperplasia of the other parathyroid gland.

Although unequivocal carcinoma of the parathyroid is rare, local invasion with definite metastasis to a regional node was discovered in one patient at the first operation. In most instances in the literature, characteristics on which a microscopic diagnosis of parathyroid carcinoma has been based are not valid. Such characteristics include variation in cell morphology, invasion of capsule and tumor cells in the lumens of veins Tumors with gross or microscopic characteristics of adenoma, which recur locally after incomplete removal, should not be designated as carcinoma. This term should be reserved for tumors which show unmistakable evidence of invasion at the time of the original operation and for those that metastasize

Primary hyperplasia and hypertrophy may cause hyperparathyroidism. It is characterized by extreme enlargement of all parathyroid tissue the total weight may exceed 65 Gm. One gland may be much larger than the others, but this is due to the relative size of the glands originally Glands may

coalesce or form pseudopods which may extend considerable distances away from the main mass Microscopically there are extremely large, clear cells. Treatment consists of removal of all except about 200 mg parathyroid tissue which is left behind so that hypoparathyroidism will not develop

In secondary hyperplasia there is slight to moderate enlargement of all glands, but they are rarely as large as a usual adenoma Microscopically the cells form compact areas, and the columnar arrangement is no longer distinguishable. These glands are composed of normal-sized chief cells or transition wasserhelle cells Such changes may progress to the formation of an oxyphil adenoma

In this series five glands were found in unusual locations. Three were in the anterior mediastinum and two behind the esophagus.

Operation must be as bloodless as possible so that the parathyroids will not be obscured If an atrophic gland is discovered, it is presumptive evidence of parathyroid adenoma Normal parathyroids should not be removed and their blood supply *should be preserved because of the danger of infarction* Parathyroids are somewhat brown before puberty but with increase in fat content they become yellow Lymph nodes, bits of adenomatous thyroid, small nodules of fat, adenomas of thyroid and portions of thymus may be mistaken for parathyroid adenoma.

Surgical Treatment of Hyperparathyroidism Report of 27 Cases is discussed by William Francis Rienhoff Jr[5] (Baltimore) Of 23 patients in this series with benign tumor or adenoma of the parathyroid gland 2 had two adenomas. One patient had diffuse hypertrophy and hyperplasia of the four glands, and in another there was definite malignant change in the parathyroid gland This made a total of 27 adenomas (Fig 33) Renal complications outnumbered osseous ones and males were affected more often than females In each instance in which there was skeletal complication, serum phosphatase level was elevated The correlation between tumor size and elevated blood calcium and between renal complications and elevated blood calcium was not striking There was one postoperative death and one recurrence Seven patients had rather severe postopera

(5) An Surg 131 917 944 June 1950

tive tetany Signs and symptoms disappeared promptly after oral administration of calcium in all but the one patient who died postoperatively

After postoperative periods of 3 11 years, there have been 9 deaths among the 25 patients All were due to hypertension with or without renal insufficiency Since complications

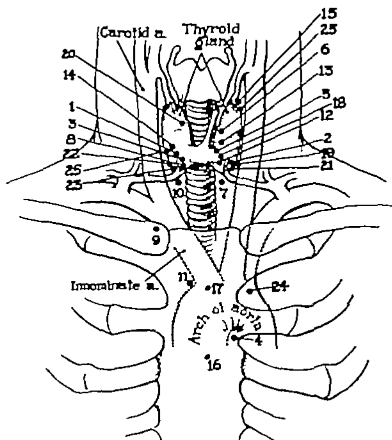


Fig. 33—Location of adenomas of parathyroid glands in 25 cases of hyperparathyroidism. No. 25 is shown both at the right lower and left upper poles. There was an additional adenoma removed a year later (not shown in diagram) which lay beneath the left lower pole making a total of 27 adenomas in 25 patients. (Courtesy of Rienhoff W F., Jr: Ann. Surg. 131 917 944 June, 1950)

were not present in some of these patients at operation, it is apparent that removal of an adenoma, with return of blood calcium, phosphorus and phosphatase levels to normal, does not halt a continuous degenerating process which goes on for several years, resulting in hypertension with or without renal insufficiency Prognosis is best in those with the least renal damage and in whom blood pressure

and blood nonprotein nitrogen, calcium and phosphorus return to normal levels within a reasonable time postoperatively

At least 80 per cent of parathyroid tissue, both normal and abnormal, is found in the region of the thyroid gland, the *remainder may be displaced either because of embryologic descent of this tissue or mechanical displacement of* an enlarged gland Development of the upper pair of parathyroid glands is simplest. They arise from the fourth branchial cleft, the lateral parathyroid primordia appearing above and behind the lateral thyroid, which arises from the same cleft. They descend in this relation to the lateral thyroid body as it descends into the neck to join the median thyroid component. The commonest position of the superior parathyroid gland is about at the junction of the middle and upper thirds of the lobe of the thyroid gland They lie in a plane dorsal to the recurrent laryngeal nerve and inferior thyroid artery The anlage of the inferior parathyroid arises from the third branchial cleft rostral to that of the superior gland and migrates caudally, along with the thymus, lateral and ventral to the pathway of the superior parathyroid and thyroid glands (Figs 34 and 35) They may finally rest *anywhere in the region from 1 cm. above the larynx to the diaphragm in the anterior mediastinum. In the adult, in*ferior parathyroids may be found in the visceral compartments of the cervical fascia or when enlarged they may be displaced caudally through the superior strait of the thorax due to gravity or intrathoracic suction (Figs 36 and 37) No parathyroid glands were found on the anterior surface of the thyroid, but in two instances they were in the thyroid.

At operation a systematic search must be made of the cervical region and secondarily of the mediastinum.

PROCEDURE.—Pentothal* sodium and curare, supplemented with oxygen administered through an intratracheal tube provides satisfactory anesthesia. The thyroid is exposed as usual. Examination is first made of the right lobe of the thyroid to note whether it contains intrathyroid nodules. The right lobe is then mobilized and rotated medially exposing first the right lower pole, inferior recurrent laryngeal nerve, inferior thyroid artery and inferior thyroid veins. In this series most parathyroid adenomas were found near these vessels, either on the right or left side. If no adenomas are found on

the lower poles, dissection is carried upward to the upper pole. All normal parathyroid glands should be carefully preserved, for nothing can be gained by their removal. Methodical search is made

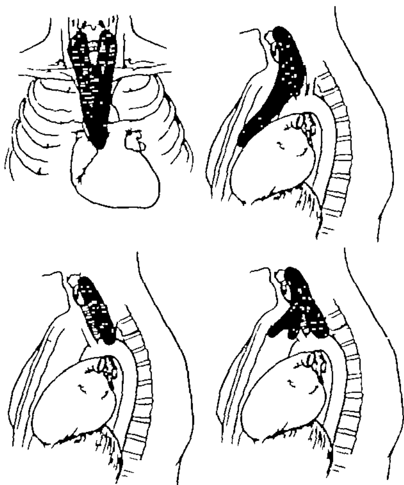


Fig. 34 (top left) —Anterior view of embryologic pathways of adult inferior parathyroid gland rising from third branchial cleft. Inferior parathyroid gland or adenoma rising from it may be discovered at any point along this pathway from 1 cm. or more above superior pole of thyroid down as far in the anterior mediastinum as the descent of thymus and lateral from the carotid sheath to midline.

Fig. 35 (top right) —Lateral view of embryologic pathways of adult inferior parathyroid gland rising from third branchial cleft.

Fig. 36 (bottom left) —Possible pathway of mechanically dislocated adenoma rising in superior parathyroid gland, from 1 2 cm. above the superior pole of the thyroid gland drawn into the superior posterior mediastinum.

Fig. 37 (bottom right) —Path of dislocation of adenoma of inferior parathyroid gland which may be aspirated into posterior or anterior superior mediastinum, depending on original position of parathyroid gland before enlargement due to development of an adenoma.

(Courtesy of Rienhoff, W F., Jr Ann. Surg. 131-91 944 June, 1950)

in the region of the right upper pole and posterolateral surface of the thyroid gland, region of pharynx and larynx, carotid sheath, retroesophageal region between the esophagus and prevertebral fas-

cia, region between the trachea and esophagus, and posterior superior mediastinum. If the adenoma has not yet been found, the same procedure is carried out on the left side. The posterior superior mediastinum is then dissected under direct vision through the cervical approach. Thymic cervical rests should be investigated for adenomas, but if none are found the thymus should be left in situ, if it is resected, normal parathyroid glands may be removed in the process. If careful dissection of the neck and superior posterior mediastinum is fruitless, the sternum is split and the anterior superior mediastinum dissected under direct vision. Adenomas may weigh 0 4-120 Gm. and are darker brown than the normal adult parathyroid gland.

If bony changes are predominant and there is a high blood phosphatase level, a portion of the adenoma should be transplanted into the thyroid or the belly of the sternocleidomastoid muscle to prevent calcium hungry bones from draining calcium ions from the blood stream and tissues to such an extent that critical postoperative tetany is produced.

When there is diffuse hypertrophy and hyperplasia of all glands, partial resection should be performed, leaving 30-200 mg hyper plastic tissue. Care should be taken to guard the blood supply of the remnant left behind.

BREAST

Role of Pathology in Lesions of Breast. Arthur Purdy Stout[6] (Columbia Univ) states that a thorough under standing of breast disease pathology is essential for diag nosis and proper application of treatment.

Gynecomastia is almost always symmetrical and consists of an increase of ducts and stroma if it occurs spontane ously it is never associated with cancer If it is a smooth uniform enlargement, its removal in elderly men for fear of malignancy is unnecessary However if it is induced by administration of diethylstilbestrol in treatment of meta static prostatic cancer it may lead to unilateral or even bilateral breast carcinoma.

Contrary to common belief, bleeding from the nipple is one of the rarest of early signs of female breast cancer but is the classic sign of intraductal papillary tumors. It

(6) South M. J 43 208-212 March, 1950.

might be expected in Paget's disease but, to Stout's knowledge, does not occur

There is no evidence to substantiate the impression that intraductal papillary tumors of the breast are precancerous growths any more than is the case with any duct epithelial cells. In no case of intraductal tumor locally removed at Presbyterian Hospital and followed 5 15 years has cancer developed in either breast.

There is no general agreement on the exact nature and probable behavior of cystosarcoma phyllodes. Seven cases were treated by radical mastectomy, five by simple mastectomy and three by local excision. In no case was there involvement of the axillary lymph nodes, and no recurrence has been observed in eight patients who were followed for 5-19 years It seems to be a relatively harmless tumor for which radical mastectomy is unnecessary partial or complete mastectomy, depending on its size, is sufficient

Breast carcinoma sometimes grows without formation of scar tissue forms a rounded ball does not produce any of the classic signs of cancer and cannot be surely distinguished from a cyst or localized area of fibroadenomatosis or cystic disease If diagnosis cannot be made by quick frozen section, it is best to close the biopsy wound and wait for the paraffin section

Carcinoma does not spread only by direct invasion through the breast tissues. It also enters the lymphatics and causes axillary lymph node metastasis which reduces the chances of cure by about 40 per cent. It may also spread in the breast via the ducts and in a few cases remains restricted to them for a considerable time Such tumors are called intraductal or comedone tumors and are slower to metastasize than the infiltrating variety A rare variant is the epidermophile which combines with an inflammatory reaction to produce Paget's disease of the nipple Breast cancer may spread also by direct invasion of veins and capillaries

Prognosis in circumscribed and intraductal carcinomas and probably also in Paget's disease and colloid carcinomas is more favorable than in the more malignant diffuse small cell carcinomas

Treatment and Results in Cancer of Breast at Presbyterian Hospital, New York City, are presented by C D Haagensen [7] *In this institution two factors have led to more* radical surgery and away from irradiation. The Halsted type of surgery, which includes meticulous dissection with exact hemostasis and gentle handling of tissues, using silk technic, has made it possible to carry out more thorough dissections with removal of more tissue. As much tissue is removed from the chest wall and axilla as possible without unreasonable danger to the patient's life or arm function. So much skin is sacrificed that a skin graft is almost always required to cover the remaining defect Skin flaps are cut thinner than in the usual radical mastectomy, and both pectoral muscles are removed entirely Despite such radical surgery there is no added morbidity or mortality because of proper attention to technical details. A second factor which has led to the sole reliance on surgery is that in an experimental series of cases intensive x ray treatment failed to destroy cancer of the breast. However, x ray treatment is regarded of inestimable value for palliation.

In selecting cases for surgery the criteria of Haagensen and Stout are recommended. Women of all age groups who are in good enough general condition to run the risk of major surgery should be treated by radical mastectomy except when (1) carcinoma has developed during pregnancy or lactation, (2) extensive edema of the skin over the breast is present (3) satellite nodules are present in the skin over the breast (4) intercostal or parasternal tumor nodules are present (5) there is edema of the arm (6) proved supraclavicular metastases are demonstrated (7) carcinoma is of the inflammatory type (8) distant metastases are *demonstrated, and (9) any two* or more of the following signs of locally advanced carcinoma are present—ulceration of the skin, edema of the skin of limited extent, solid fixation of the tumor to the chest wall, axillary lymph nodes measuring 2.5 cm. or more in transverse diameter and proved *to contain metastases by biopsy* and fixation of axillary lymph nodes of the skin or deep structures of the axilla.

Radical mastectomy was performed in 495 of 668 primary

(7) Am. J Roentgenol. 62 328-334 September 1949

cases of breast carcinoma between 1935 and 1942. The absolute five year survival rate was 47.2 per cent and the absolute five year cure rate 38 6 per cent. Local recurrence developed in 14.5 per cent. The relative five year survival rate was 58.2 per cent and the relative five year cure rate

TABLE 1.—RESULTS OF RADICAL MASTECTOMY ACCORDING TO LENGTH OF OPERATION

LENGTH OF OPERATION MIN.	CASES	OPERATIVE DEATHS		5 YR. LOCAL RECURRENCE		5 YR. CLINICAL CURE	
		No.	%	No.	%	No.	%
1-59	0						
60-119	17	1	5 9	4	23.5	4	23.5
120-179	74	2	2.7	11	14.9	33	44.6
180-239	145	2	1 4	21	14.5	67	46.2
240 or more	259	4	1.5	36	13.9	137	52.9

TABLE 2.—RESULTS OF RADICAL MASTECTOMY ACCORDING TO FIVE YEAR PERIODS

PERIOD	CASES	OPERATIVE DEATHS		5 YR. LOCAL RECURRENCE		5 YR. CLINICAL CURE	
		No.	%	No.	%	No.	%
1915-19	128	3	2.3	32	25.0	34	26.6
1920-24	127	7	5.5	24	18.9	37	29.1
1925-29	160	8	5.0	42	26.3	53	33.1
1930-34	225	2	0.9	48	21.3	107	47.6
1935-39	314	5	1.6	52	16.6	146	46.5
1940-41, 42	181	4	2.2	20	11.0	95	52.5

48 7 per cent. In 94.9 per cent of the cases the disease was operable according to the criteria given In these the five year cure rate was 71 8 per cent when the axillary nodes were not involved but only 37 8 per cent when axillary metastases were present. *In 25 cases in which the disease* was inoperable according to these criteria, yet radical mastectomy was done, only one patient survived as long as five years and the local recurrence rate was 40 per cent.

Table 1 presents data which illustrate the advantage of a thorough operation, in that the cure rate rose and the frequency of local recurrence fell as the length of time devoted to operation increased. Improvement in results of treatment at Presbyterian Hospital during the last genera

tion seems to have occurred without use of x ray therapy, for this procedure has been used infrequently during recent years (Table 2) A more critical selection of patients for operation is probably the main factor

Treatment and Results in Cancer of Breast. Grantley Walder Taylor[8] presents a summary of results in cases seen at Massachusetts General Hospital since 1894 (table) Patients selected for radical mastectomy since 1936 have been chosen *according to the criteria of Haagensen* and Stout In general, a standard radical operation has been

SUMMARY OF DATA IN CASES SEEN SINCE 1891

	1894 to 1904	1911 to 1914	1918 to 1920	1921 to 1923	1924 to 1926	1927 to 1929	1930 to 1932	1933 to 1935	1936 to 1940
Total primary cases	468	103	134	183	208	220	231	328	
Radical operations	360	74	100	148	158	180	185	236	395
Operability %	77	72	75	80	74	80	80	72	
Died without recurrence in less than 5 yr				6	11	10	11	14	11
Axilla free %	33	31	30	28	41	36	37	40	41
Cures in 1 A cases, %		56	54	62	64	74	70	75	78
Cures in 1 C cases, %		24	23	21	26	24	31	33	34
Cures in all operations, %	19	27	30	35	41	43	45	50	52

performed Skin removal is less extensive than that practiced in some places and skin grafting is necessary in less than 10 per cent of cases

Presence or absence of axillary lymph node involvement is the most significant factor in determining prognosis post operatively When disease is limited to the breast, chance of cure is about 75 per cent, but when there is axillary involvement it is about 33 per cent. When only one or two nodes *contain metastases, prognosis is nearly as favorable* as when there is no metastases but results become progressively worse with more extensive involvement. The grade of malignancy is of great significance in prognosis. Lesions of high grade malignancy have a poorer prognosis than those of low grade Age is another significant prognostic factor in that young women have a greater proportion of carcinomas of high grade malignancy with earlier involvement of axillary lymph nodes *Duration of the pri*

(8) Am. J Roentgen L 42 341 344 September 1940

mary tumor is of great significance in the individual case Small tumors have a much more favorable prognosis than large tumors A poor prognosis can be given in cases with skin involvement and ulceration

In this series it was not possible to establish that prophylactic x ray treatment has improved results of operation or decreased or deterred appearance of operative field re currences Castration, either surgical or by x rays, has not increased the curability in this series It is only used in treatment of inoperable and recurrent cancers in young women. The most striking favorable results are observed in patients with skeletal metastases In elderly patients with inoperable and recurrent carcinomas, estrogenic hormones may cause regressions of local and lymph node disease and of pulmonary metastases Androgenic hormones appear to be beneficial primarily in patients with skeletal metastases.

Cancer of Breast H. Glenn Bell[9] analyzed 819 cases seen at University of California Medical Center from July 1, 1930 to Jan. 1, 1944 in 83 no treatment was given at the Center, but the patients were followed, in 736 some form of definitive or palliative treatment was given. Of the whole series of patients, 264 (32 2 per cent) were well five or more years after treatment There were four operative deaths (0 85 per cent) in 470 primary surgical cases

Schenck's classification was used. The five year survival rate was 61.8 per cent for 173 patients in stage I, 39 8 per cent for 201 in stage II and 8 3 per cent for 203 in stage III In these three groups, which include all patients with pri mary carcinoma, there were 105 who were given roentgen therapy alone, which in most instances was palliative Of the 470 patients in whom a definite attempt at cure was made by surgery with or without radiation, 201 lived five years without recurrence Thus, the five year survival for those with operable lesions was 42 8 per cent. In stage IV 24 (22 6 per cent) of 106 patients who had a recurrence of a carcinoma that had been operated on elsewhere were well five or more years after treatment. In stage V, 53 (39 per cent) of the group who had surgery elsewhere followed by roentgen therapy at University of California Hospital were well over five years. In stage VI 15 (18 per cent) of the

(9) Ann. Surg 130:310-317 September 1949

83 patients who were simply followed after treatment elsewhere lived five years without recurrence

Statistically, the possible benefits of roentgen therapy are not reflected in the five year survival rate In stage I the highest five year survival was in patients who had radical surgery only In stage II the slightly higher survival rate with preoperative roentgen therapy is probably not significant. In stage III use of radiation resulted in a somewhat larger percentage of five year survivals of 14 patients who had simple mastectomy plus postoperative irradiation 21.4 per cent were well five years later, as compared with 16 6 per cent of patients who had radical surgery alone In the entire group use of pre or postoperative roentgen therapy did not increase the number of five year survivals The 10 year survival rate for stage I and stage II regardless of treatment is 41 8 per cent.

Marked swelling of the arm occurred in 11 (3 4 per cent) of the surgically treated patients and in 13 (5 8 per cent) *of those treated with surgery supplemented by roentgen* therapy in none was the swelling incapacitating

Treatment and Results in Cancer of Breast Stanford Cade[1] (London) has adopted U V Portmann's classification as a guide for treatment of breast cancer Stage I is characterized by tumor of the breast only stage II, by tumor

PER CENT OF 5 AND 10 YEAR SURVIVALS IN 263 CASES (1932-38) ON BASIS OF TREATMENT

Stage	Surgery		Radium		Surgery + Radium	
	5 Yr	10 Y	5 Yr	10 Yr	5 Yr	10 Yr
I	87	65	70	60	78	65
II	29	25	25	21	35	32
III	9	7	15	13	10	9

plus skin changes and/or axillary lymph nodes stage III, by tumor plus supraclavicular lymph nodes, contralateral axillary lymph nodes or fixation to pectoral fascia, stage IV, by skeletal or visceral metastasis.

The *only* adequate *surgical* treatment for breast cancer is radical mastectomy Successful radiotherapy may be *given with either radium or x rays,* the only advantage of

(1) Am. J Roentgenol. 62 326-327 September 1949

radium being the greater tissue dosage achieved. Since adequate radiotherapy leads to clinical regression of the tumor it is obvious that preoperative irradiation is of greater value than postoperative There is statistical evidence that preoperative irradiation gives improved long term results.

Choice of treatment can be summarized as follows stage I, radical surgery, stage II, preoperative radiotherapy and radical surgery, stage III, radiotherapy only Surgery in stage III is not warranted and often leads to more rapid progress of the disease than if no treatment were given. Survival data on 263 cases, divided according to method of treatment, are shown in the table

Treatment and Results in Cancer of Breast Elis Berven[2] (Univ of Stockholm) reviews results in 3,623 patients observed during 1921-41. Cancer was too advanced for treatment in 740 Palliative treatment was given to 544 whose condition was inoperable on admission, and different types of radiation were administered to 535 who had recurrences after operation elsewhere Criteria of inoperability were fixation of the tumor to the thoracic wall or evidence of massive and fixed metastases to the axillary lymph nodes, supraclavicular fossa or distant organs.

Between 1921 and 1935 1,035 patients were treated by radiation and surgery with a five year cure rate of 42 per cent and survival rate of 46 per cent. Between 1936 and 1941, 796 patients were similarly treated, with a five year cure rate of 43 per cent and survival rate of 51 per cent. During the two periods, about 40 per cent of the operable patients had stage I (Steinthal) and 60 per cent stage II lesions (Steinthal) This proportion between the two stages has not improved in the past 21 years despite increasing efforts to educate the public to seek medical advice as early as possible

Between 1936 and 1941, 203 patients with stage I cancers received pre and postoperative irradiation and 95 received postoperative roentgen treatment only but the five year survival rate was 66 per cent in each group In the same period 354 patients with stage II cancers received pre and postoperative x ray treatment and showed a five year sur

(2) Am. J Roentgenol 62:320-325 September 1949

vival of 43 per cent, but only 36 per cent of 117 patients who received postoperative treatment only survived for five years. The data in this group, while not fully significant statistically, indicates the importance of preoperative treatment. Additional evidence is given in the accompanying table, in which the figures strongly support the assumption that preoperative roentgen treatment greatly improves the prognosis in cases in which the cancerous growth has begun

DATA ON 451 CASES IN STAGE II (1936-41) DIVIDED ACCORDING TO EXTENT OF AXILLARY METASTASES

Group	Postoperative Roentgen Treatment		Pre and Postoperative Roentgen Treatment	
	Cases	Survivals	Cases	Survivals
1 (Metastasis to one node)	18	13 (72%)	79	57 (72%)
2 (Metastases to several nodes)	69	27 (39%)	164	62 (38%)
3 (Periglandular infiltration in axilla)	30	2 (7%)	91	29 (37%)

to invade the axillary tissue Since it is not possible clinically to determine whether the growth is in stage I or II, it is imperative that peroperative treatment be given in all cases

Treatment of Cancer of Breast by Simple Mastectomy and Roentgen Therapy Robert McWhirter[3] (Royal Infirm. Edinburgh) states that publication of results of selected cases has tended to give the impression that radical mastectomy is a highly successful method of treating mammary cancer, but five year survival does not exceed 25 per cent when all cases referred to a large general hospital are included in the total on which survival rate is based Therefore the value of combining postoperative roentgen therapy with radical mastectomy was investigated. The method reduced the number of local recurrences, but many patients continued to die of distant metastasis. This led to the belief that dissection of the axilla might cause dissemination of malignant cells to sites beyond the area which could be

(3) Arch. Surg 59 830-842 October 1949

irradiated. To overcome this difficulty it was decided to continue to remove the breast surgically but that treatment of the axilla should be by roentgen rays alone because surgical removal of the nodes is unnecessary when the axilla is not involved and often fails when it is Soon after this method was introduced it was found that a much higher proportion of patients could be given full treatment than had been possible before In addition patients with fixed axillary nodes and nodes in the supraclavicular region were treated with considerable success. The wound heals more quickly after simple mastectomy, roentgen therapy can be applied with less delay and the interval during which cells may escape to distant sites is thus reduced. Furthermore edema of the arm is almost unknown.

In 1941-45 1,451 cases of cancer of the breast were referred to the Royal Infirmary, 1,334 were primary and 117 were referred only after recurrence Each primary case was classified when first seen, stage I and II (Paterson) cases constituted 56 per cent of the total. Previous experience indicated that, when the two stages are taken together to form the operable group it may be presumed that in 40 per cent the axillary nodes are not histologically involved For further convenience in presentation of results the advanced cases were divided into two groups according to whether or not distant metastases were present There were 11 postoperative deaths

Full treatment was possible in almost all operable cases and five year survival rate was 62 1 per cent During 1935-40 when the main method of treatment was radical operation and postoperative roentgen irradiation it was 50 1 per cent Of patients with advanced cases without distant metastases during 1941-45, 29 per cent were alive after five years this demonstrates that roentgen therapy is effective treatment of the axilla even when axillary involvement is gross. Five year survival for all cases referred during 1941-45 was 43 7 per cent and during 1935-40 32 4 per cent

[The diverse opinions expressed in these various articles about the value of x ray therapy as a supplement to the surgical treatment of cancer of the breast certainly leave the reader confused. When there is so much diversity among those who presumably have made equally careful and honest statistical studies of their cases, it would seem reasonable to take the position

that the value of x ray therapy has certainly not yet been established in any but the inoperable cases.—Ed.]

Internal Mammary Lymph Chain in Carcinoma of Breast. R. S Handley and A. C Thackray[4] explored the anterior mediastinum through the second or third intercostal space in 50 consecutive cases and found that the internal mammary chain was invaded in 19 in 16 the deposits were in lymphatic glandular tissue, in 2 in the connective tissue adjoining the internal mammary artery, and in 1 within the lumen of a mediastinal venule, in 3 of the 19 the internal mammary chain alone was invaded and in 16 both axillary and internal mammary glands were involved. The axilla alone was invaded in 15 No glandular deposits were found anywhere in 16 Of the 13 primary growths in the inner half of the breast which showed glandular deposits, 12 had metastasized to the internal mammary chain and only 1 had invaded the axillary glands alone To expose the internal mammary chain is easy, but to find the lymph nodes is difficult because they are often exceedingly small.

Technic.—The chest wall having been exposed over the second or third intercostal space, an incision 1¼ in long is made in the intercostal musculature, parallel to the costal cartilages and midway between them and extending medially to the edge of the sternum. The fibers are cautiously divided until the mediastinal fat appears or the lung is seen through the pleura to be sliding to and fro Dissection then proceeds with two fine nontoothed forceps and gauze. The internal mammary vessels lying about ¼ in. lateral to the edge of the sternum are picked clean. A lymph node is often encountered in the superomedial angle of the space. All tissue removed deep to the internal intercostal muscle should be sectioned and will generally show unsuspected aggregations of lymphoid follicles. A tear in the pleura, if recognized, is of no consequence when the anesthetist has been forewarned of the possibility The intercostal space cannot be closed after the exploration, since the intercostal muscles will not hold sutures.

Exploration of the second intercostal space is not to be regarded as a method of treatment for carcinomatous deposits in the internal mammary chain, but as a reconnaissance designed to give fuller information about the movements of the carcinoma cells. The only method of dealing with these deposits so far reported is implantation of radium tubes in the medial end of the intercostal spaces, and its efficacy has not yet been unequivocally proved.

(4) Lancet 2 276-278 Aug 13 1949

Categorically Inoperable Carcinoma of Breast William L. Tomlinson and Clarence T Eckert[5] (St. Louis) applied the criteria of inoperability, established by Haagensen and Stout at Presbyterian Hospital, New York City to all cases of breast carcinoma seen at Barnard Free Skin and Cancer Hospital between 1933 and 1943 Of these, 167 fell into the categorically inoperable group in 100 routine radical mastectomy or some similar radical operation had been done, and in the other 67 only roentgen therapy had been used. Of the surgical patients, only 2 were well and clinically free from carcinoma at the end of 5 years 1 for 8 and the other for 14 years Both had carcinoma associated with pregnancy or lactation, there were only three such patients in this series.

The question of whether a category of inoperability, in technically operable cases, is justifiable is of great importance. The fact that there were only two possible cures in the present series indicates the poor results which can be expected in cases in this category Strangely enough, both survivals were in cases associated with pregnancy Harrington reports more encouraging results in the treatment of breast cancer in the course of pregnancy and lactation. Haagensen also recently pointed out that radical mastectomy may be justified in these cases, if the disease is locally operable

The 36 8 months average survival for surgically treated patients in the present series is quite close to that of 32 3 months for a surgically treated group from Presbyterian Hospital, now considered inoperable by the Haagensen Stout criteria The Barnard group treated by roentgen rays alone had an average survival of 34.2 months, which is somewhat shorter than that (42 3 months) for the group from Presbyterian Hospital who were regarded as inoperable and were not treated by surgery and radiation.

Thus, it appears that as a rule, patients with mammary cancer who fall into the Haagensen-Stout category of inoperability will not profit by radical surgery At this time, patients whose cancers occur during pregnancy or lactation may be an exception. It is also possible that other criteria of inoperability may be proved to be questionable

(5) Ann. Surg. 130 33-4.., July 1949

However, only by classifying cases against definite standards of involvement will it be possible to arrive ultimately at certain standards for the most beneficial treatment.

Implications of Local Excision or Simple Mastectomy Prior to Radical Mastectomy for Carcinoma of Breast. Charles E Lockhart and Lauren V Ackerman[6] (Washington Univ) studied 41 patients with proved carcinoma of the breast who had had simple mastectomy or local excision of the tumor for diagnostic purposes. Twenty two had radical mastectomies after admission and 19 were considered inoperable on admission. Of the entire group only nine patients are living without disease, in all these the interval between the primary procedures and radical mastectomy was two months or less Only five of the inoperable group were admitted within two months after surgery Such findings emphasize the importance of a short interval between the initial biopsy and radical treatment

Among the 19 patients originally treated by simple mastectomy, it was feasible to do radical mastectomy in only 6, and only 2 of these are living without disease The radical operation was not performed in the others because they were considered inoperable at hospitalization. Probably patients with obvious local recurrence or regional lymph node metastases after simple mastectomy should not be subjected to radical mastectomy, but they might benefit more from palliative irradiation Among 22 patients initially treated by local excision, radical mastectomy was justified in 16 and 7 are living without disease.

In the patients who had radical mastectomy clinical examination proved inaccurate for detecting the presence of persistent tumor or axillary involvement Histologic examination disclosed that errors were made in 12 of the 22 cases In three of the successfully treated patients persistent tumor was found in the histologic specimen at the site of previous excision.

When a patient has a single lump in the breast the tumor should be exposed in the operating room, and if there is any doubt as to its nature a frozen section should be made When the suspected single nodule is small (2 or 3 cm.) it may be removed completely with a margin of healthy sur

(6) Surgery 26:577-583 October 1949

rounding breast tissue In the case of larger lesions total excision is not practicable and incisional biopsies should be performed. Under no circumstance should aspiration biopsy or simple mastectomy be used as diagnostic procedures

Results in this series showed that once simple mastectomy has been done for cancer the prognosis is extremely poor in practically every instance When radical mastectomy is performed for cancer after simple mastectomy a far more extensive and difficult operation is required. The area previously undermined in the raising of flaps for the first operation must be removed widely leaving a tremendous defect on the chest wall which necessitates use of a skin graft. Local recurrences are common after simple mastectomy because the amount of skin sacrificed is small and relatively thick skin and subcutaneous tissue flaps are usually dissected, an incision often being made across strands of tumor which reach toward the skin surface, these flaps are subsequently plastered down against denuded pectoral fascia providing an excellent bed for growth of residual tumor Simple mastectomy is also performed too often for large tumors which cannot be encompassed by local excision From a diagnostic viewpoint simple mastectomy rarely provides more information than can be gained by simple biopsy of the tumor mass Biopsies of breast tumors should be made with facilities for subsequent radical mastectomy immediately available, not only because most patients prefer to be treated completely at one time but because many human factors may intervene after biopsy and cause delay which may be disastrous.

Postmastectomy Swelling of Arm With a Note on Effect of Segmental Resection of Axillary Vein at the Time of Radical Mastectomy Allan W Lobb and Henry N Harkins[7] (Univ of Washington) report that 41 of 61 patients on whom unilateral radical mastectomy was performed showed an average arm swelling of 2.5 cm. on the side operated on. The swelling was 3 cm. or more in 22 per cent, the greatest amount recorded was 10 5 cm

Analysis based on age suggested that the decreased tissue turgor of older persons may cause a tendency toward

(7) West. J Surg 57 550-557 November 1949

fluid accumulation. The predominant influences on arm swelling after mastectomy appeared to be x ray treatment, skin recurrence and impaired arm function. Arm swelling did not seem related to skin grafting, axillary metastasis, wound infection or operation on the side of dominant handedness

A 4-8 cm. segment of axillary vein was excised and the cephalic vein preserved in four cases In three there was no swelling, and in the other there was swelling of the fore-arm but only slight swelling of the upper arm. This procedure may be performed to remove adherent carcinomatous lymph nodes with the expectation of little significant post operative swelling

Incidence of Swollen Arms after Radical Mastectomy and Suggestions for Prevention. Ernest M. Daland[8] (Pondville Hosp., Walpole, Mass) examined 90 patients after radical mastectomy for cancer 1 was later found not to have had the disease All were apparently free from disease at examination.

In five patients the circumference of the upper arm on the side operated on was less than that on the normal side this also applied to the forearm of six patients Since these patients had normal function and no evidence of muscle atrophy, this finding is best explained by the normal variation between the two arms and the inaccuracy of the measurements.

No difference in measurements of the two arms was noted in 18 patients, 21 had no swelling of the upper arm and 31 none of the forearm, an increase of 0 5 cm. in circumference considered within normal limits, was noted in 16 upper arms and 18 forearms. Thus, 41 patients (45 per cent) had no swelling of the upper arm and 50 (55 per cent) had none of the forearm

Anything over 0 5 cm. increase in circumference was regarded as swelling and increases of 1-2 5 cm. were considered as slight swelling There were 28 upper arms and 25 forearms in this category (31 and 27 per cent, respectively) None of these had brawny lymphedema and most of the upper arm swellings were soft because of relaxation from the axillary dissection. All these patients had normal use

(8) New England J Med. 242:497-502, Mar 30 1950

of their arms, and many were unaware that they had any swelling

Moderate swelling applied to increases of 2.5-4.5 cm. In this group there were 16 upper arms and 9 forearms (17 and 10 per cent, respectively) In only one case was there slight limitation of motion. In some cases the edema was firm and seemed to be of the lymphatic type

Severe swelling of the upper arm was present in five patients (5 5 per cent) and of the forearm in six (6 6 per cent) Many of these had severe disability from the weight of the arm, although all but two had normal range of motion.

The Greenough modification of the Rodman incision (Figs. 38 and 39) was used in all patients It consists of a trans-



Fig. 38 (left) —Arrowhead-shaped incision for radical mastectomy
Fig. 39 (right) —Closure of incision, leaving no scar on arm.
(Courtesy of Daland, E. M. New England J Med. 242 497-502 Mar 30 1950)

verse axillary incision with an arrowhead shaped incision about the breast A segment of skin between the breast and the axilla is removed. The axillary dissection is completed before the breast is removed. When the incision is closed, there is no scar on the arm. Cotton ligatures are used. All wounds are drained for three to five days Moderate pressure is applied to a large dressing Early use of the arm is the rule but the patient is told not to do exercises.

Preoperative roentgen treatment has not been used in Pondville Hospital in recent years, and postoperative roentgen treatment is given only when pathologic condition persists after operation. Prophylactic treatment was given to 13 patients, 9 of whom had enlargement of the upper arm of 2.5-15 cm. and 6 enlargement of the forearm of 2.5-11 cm. The patients with the greatest amount of swelling were those who received the highest doses of x rays

Accumulation of serum in the wound must be avoided because it causes fibrosis If roentgen therapy is given, care must be taken *to avoid a cicatricial band of scar* through the axilla, for it will produce swelling

Treatment of Advanced Mammary Cancer with Estrogens. Max Cutler, Melvin Schlemenson, John J Kearney (Chicago) and Eduardo Caceres[9] (Lima, Peru) treated 20 patients with large doses of both synthetic and natural estrogenic substances, *including diethylstilbestrol monomethyl* ether, diethylstilbestrol and a solution of estrogens in oil, principally estrone No essential difference in response was noted and vaginal smears demonstrated the follicular phase of the menstrual cycle in all

In 13 patients the disease progressed and the patients were not benefited. In four of these there were metastases to bone In three patients the general condition was decidedly improved and the disease temporarily arrested In four ulcers of the breast healed and treatment was believed beneficial. In one of the seven patients in whom there was definite improvement metastasis to a lumbar vertebra showed deposition of calcium Correlation of age with response to estrogens indicated that palliation can be expected most frequently in patients over age 60 Since the patients have not been observed long enough the exact duration of palliation cannot be discussed. Certain patients with advanced cancer of the breast experience relief from pain and a sense of well being during estrogen therapy even when there is no objective improvement.

Though there was no evidence that the disease was accelerated in any case other observers have suggested that this may occur in young women. Cautious treatment is advised for that group

(9) Surgery 26:567 572 October 1949

LUNG

General

Diagnostic and Prognostic Value of Pulmonary Function Tests Julius H. Comroe, Jr., and William S Blakemore[1] (Univ of Pennsylvania) describe six types of pulmonary function tests which are of value to the thoracic surgeon

METHODS.—1. Static lung volumes measure maximal air inspired at the resting expiratory level (inspiratory reserve normally 3,500 cc.) and maximal air expired (expiratory reserve normally 1,000 cc.) Vital capacity (sum of inspiratory and expiratory reserves) is measured with ordinary basal metabolism apparatus. The air remaining after maximal expiration (residual capacity normally 1,500 cc.) is measured indirectly by calculating the nitrogen in the expired air of a patient breathing 100 per cent oxygen for seven minutes (method of Darling *et al.*) A change of 100 cc. in repeated serial measurements is significant if the patient is co-operative

2. Dynamic lung volumes measure the rate, depth and minute volume of breathing Maximal breathing capacity is measured by requiring the patient to breathe as deeply and as rapidly as he can for 15 seconds. When maximal breathing capacity is greatly reduced in a co-operative patient with a normal vital capacity respiratory obstruction or decreased lung elasticity is suspected. An increase in the ratio above 1 1.3 of the inspiratory and expiratory time during quiet breathing suggests mechanical difficulties in expiration. The breathing reserve is the difference between maximal breathing capacity and minute volume and correlates with the degree of dyspnea.

3 Intrapulmonary gas mixing is measured by breathing oxygen for seven minutes. If nitrogen content of the terminal maximal expiration is more than 2.5 per cent, poor mixing is assumed. This is often observed in patients with obstruction (asthma, etc.) or emphysema.

4. The diffusion rate of oxygen across the alveolar capillary membrane is not accurately measured quantitatively with uneven mixing Krogh's quantitative method involves inhalation of carbon monoxide in low concentrations. Semiquantitative methods involve measurement of arterial oxygen saturation before and during exercise. An other method (oximeter test) involves charting the arterial oxygen saturation from 97.5 to 100 per cent as the resting patient is given 100 per cent oxygen. The procedure takes longer with a diffusion barrier

5 Pulmonary blood flow, arterial pressure and even capillary pressure can be measured with the vascular catheterization technic

(1) S. Clin. North America 29 16 1 1631 December 1949

but measurements are infrequently made. They reveal an inadequacy of the pulmonary vascular bed which may indicate right ventricular failure after lobectomy or pneumonectomy

6 Arterial blood oxygen and carbon dioxide studies serve as over all function tests. Oximeters do not give as accurate quantitative values as chemical determinations. Venous blood oxygen does not indicate arterial oxygen saturation. Arterial oxygen may be low in the absence of lung disease (as in right to-left shunt) and normal with *serious lung disease. Increased arterial carbon dioxide may be* present in either alkalosis or acidosis. Blood pH studies are therefore valuable. Patients with serious pulmonary disease may have high, low or normal arterial carbon dioxide content, but, if it is high preoperatively, as little functioning lung tissue as possible should be removed to maintain compensatory hyperventilation.

Two cases follow which illustrate the use of pulmonary function tests.

CASE 1.—Man, 67, under treatment for tuberculosis for six years, was admitted because of a possible neoplastic complication. A chest x ray one month before had revealed increased infiltration in the upper third of the left lung and a needle biopsy locally revealed a primary squamous carcinoma. Pulmonary function studies suggested a clinical diagnosis of pulmonary emphysema because of a high residual capacity, decreased inspiratory reserve, normal total capacity, poor mixing, anoxemia and respiratory acidosis. Although the patient was a poor operative risk, left pneumonectomy was done. Postoperatively, he had severe dyspnea and died suddenly 24 days later At autopsy *emphysema and edema of the remaining lung were* found.

CASE 2.—Woman, 42, had a history typical of pulmonary hemangioma, including nosebleeds, multiple telangiectasias of skin and mucous membranes, hemoptysis, cyanosis and a familial history which included some or all of these complaints. Radiologic studies revealed two shadows at the left border of the heart. Cardiac studies were negative. A diagnosis of disease of the pulmonary parenchyma was excluded by pulmonary function tests which revealed a low arterial oxygen saturation and normal lung volume. A physiologic diagnosis of right to-left shunt was therefore made.

[Tests of pulmonary function are of very great value in some cases, and *they may serve as a deciding factor* in a question of whether or not to perform an extensive resection. In the future they will be used even more than now—Ed.]

Experimental Observations on Embolism of Pulmonary Lobar Arteries in dogs are reported by Masauki Hara and John R. Smith[2] (Washington Univ) who used small inflatable balloons, dried pea seeds, navy beans threaded together glass beads, poppy seeds and a spreading instrument to

(2) J. Thoracic Surg. 18:526-542, August, 1949

obstruct, distend or irritate the vessels Distention or occlusion of the main pulmonary or lobar arteries did not provoke recognizable reflex or significant mechanical alterations of cardiovascular dynamics. Occlusion of twigs of the pulmonary lobar arterial system to about 0 5 mm. diameter produced no significant effects on cardiovascular mechanisms if the embolization was confined to one lobe and widespread mechanical block thus avoided. Nor did mechanical irritation of the lobar vessels and their extreme distention without occluding them have any immediate effect on the circulatory mechanisms

It therefore seems unlikely that sudden death or immediate distortion of cardiovascular function would follow emboli to the larger lobar vessel systems unless critical mechanical obstruction is established. However in experimental animals death has occurred several hours after large pulmonary embolism has been sustained the mechanism of death is not clear Megibow Katz and Steinetz suggested that thrombi generated by large emboli may be propagated or disseminated to other parts of the lung arterial system. The evidence advanced by Haynes and associates suggesting that capillary or precapillary embolization may cause violent acute reflex cardiodynamic effects raises the possibility that, after obstruction of large arteries, the finest vessels become occluded, possibly by miliary fragmentation of thrombi originating from such major pulmonary emboli.

Surgical Management of Respiratory Emergencies during First Few Weeks of Life Leon J Leahy and Winfield L. Butsch[3] (Children's Hosp, Buffalo) describe three cases in which radical surgery was necessary when dyspnea and cyanosis noted at birth failed to improve

Case 1—In a boy aged 11 weeks, onset of breathing was slow after an extremely difficult delivery and mechanical resuscitation was necessary Because of temperature of 101 F penicillin was given. When he left the hospital he breathed with difficulty and retracted both ribs and abdomen with each respiratory effort. At age 6 weeks a wheeze developed which became progressively worse After episodes of respiratory distress he was readmitted 1 chest x ray was suggestive of emphysema in the left upper lobe It bronchoscopy the orifice of the left upper lobe bronchus could not

(3) Arch Surg 59 466 483 September 1949

be seen because of a slight bulge in this area, suggesting that mucosa was everted at the opening Thoracotomy, at age 14 weeks, showed the left upper lobe definitely emphysematous. The lobe was resected, using the individual ligation technic. Recovery was uneventful, and symptoms were completely relieved.

The etiologic factor was not determined Sections from the resected lobe showed alveolar emphysema with some blebs of considerable size Dissection of the gross specimen and microscopic study failed to show any obstructive lesion. *There was no evidence of pneumonia The significance of the* respiratory difficulties at birth and the evidence of pulmonary infection is unknown Although evidence of bronchial obstruction was not positive, the bronchoscopic findings were highly suggestive

Case 2.—Boy, delivered normally at term, shortly after birth had rapid, labored respirations and cyanosis. A chest x ray showed atelectasis of the right upper and lower lobes and emphysema of the middle lobe. Bronchoscopy showed a swollen membrane and thick mucus occluding the right main bronchus. After the mucus was removed and the bronchus dilated, breathing improved. The upper lobe expanded, the middle lobe became less emphysematous, but the lower lobe remained atelectatic. The child was readmitted three weeks later for cyanosis and labored breathing X ray diagnosis was pleural effusion on the right side with mediastinal shift. During the next two weeks six thoracenteses were performed and varying amounts of fluid removed An x ray after one of these procedures disclosed a cystlike pocket with a fluid level. Thoracotomy was done at age 7 weeks and a gastrogenic cyst removed. Recovery was uneventful, and symptoms were completely relieved.

With the increasing frequency of thoracic exploration, *intrathoracic cysts of gastric origin are being encountered* more commonly The chief symptoms are those of pressure in the mediastinum Cough, cyanosis, dyspnea and regurgitation of food result If there is pressure on the bronchus the course may be similar to that in Case 2 If the child lives long enough, recurrent pneumonia and bronchiectasis develop Hematemesis has resulted from pressure on the esophagus. Peptic ulceration of the gastric cyst with penetration into the lung is rare Aspiration of the cyst may lead to infection and should be avoided if diagnosis can be made otherwise Immediate excision of the cyst is the safest course

Case 3 also emphasizes the futility of conservative efforts to overcome dyspnea and cyanosis when the underlying condition is congenital cystic disease of the lung

CASE 3—Boy was delivered normally at term. Breathing has never been normal since birth. The child cried in gasps and turned blue when crying hard. Oxygen was given on several occasions for dyspnea. A chest x ray showed pronounced emphysema of the entire left lung with bleb formation particularly at the base. Operation revealed numerous cysts in the lung particularly the upper lobe which was completely replaced by large cysts. Pneumonectomy was performed at age 7 weeks. The child was discharged without any breathing difficulty.

The pulmonary cyst which causes a serious degree of respiratory distress is the expansile or balloon cyst. All these cysts are connected with the bronchial tree, but when the connection is of the tortuous type air may be trapped within them, producing great enlargement. The expanding chest lesion may cause severe displacement of mediastinal organs and pulmonary compression; both of these were noted in Case 3. Aspiration of these cysts may lead to infection or a leak in the cyst wall, causing tension pneumothorax. Usually lobectomy or pneumonectomy is required for adequate treatment, but sometimes the primitive bud from which the cyst has developed is so separated from the rest of the lung that the cyst can be removed by ligating its pedicle.

SUPPURATION—ANOMALIES

Pulmonary Lobectomy: Experience with 110 Consecutive Resections without Operative Mortality in 104 men and 1 woman is reported by Bernard J Ryan[3] (Veterans Admin. Hosp., Bronx, N. Y.). Operations on all but five or six patients were performed by the residents on the thoracic surgery service.

There were 64 operations for bronchiectasis. Nearly every patient with unilateral disease completely eliminated at operation had good results. In seven, all but one of whom had broncographically demonstrated bilateral disease, results were poor. There were 20 resections of lung for chronic lung abscess. All the patients left the hospital asymptomatic except one still hospitalized, in whom pulmonary tuberculosis developed. Of the others, 16 are well, 2 have been operated on too recently for follow up and 1 cannot be located. Lobectomy was performed for peripheral carcinoma

(3) Surgery 7 531-555 April, 1950

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(5) Surgery 27:551-558, April 1950.

in five patients, of whom three are now working full time, one is well but not working and one has evidence of metastases in both lungs In two patients with limited pulmonary reserve, lobectomy was performed because of carcinoma, but both subsequently died of this disease The five patients who were subjected to lobectomy for active tuberculosis before January 1948 are now working Sanatorium care is being given four additional patients similarly treated for this disease

The importance of maintaining an adequate airway and dry tracheobronchial tree and providing sufficient oxygen during and after operation cannot be overemphasized Blood transfusion was routine in all cases during operation. In all instances individual dissection and ligation silk technic were used in dealing with the hilar structures. Posterolateral approach with rib resection was used in lower lobe lobectomies and most upper and middle lobe resections The 72 hours after operation are crucial and the patient must be constantly protected against anoxia Before operation he is instructed on the importance of postoperative coughing and deep breathing Postoperative tracheal suction after Haight s method is routine There were no operative deaths, but two patients died of carcinoma several months postoperatively The commonest complications were atelectasis, *empyema and bronchopleural fistula. Frequent physical* and x ray examinations are imperative for the detection of these and other postoperative complications such as pneumothorax and hemothorax.

Segmental Pulmonary Resection Details of Technic and Results Richard H Overholt, Francis M Woods and Beatty H. Ramsay[6] (Tufts College) state that there are essentially four steps in this resection (1) the *segmental artery* is dissected out ligated and divided (2) the segmental bronchus is cleared, ligated distally and divided and the proximal stump closed (3) the segmental vein when present, is ligated and divided (4) the segment to be removed is separated from the lobe by locating the intersegmental vein in the hilus of the segment and following this as a guide to the intersegmental plane The *first three steps are* carried out in the most convenient order If subpleural

(6) J Thorac Surg 19 207 225 February 1950

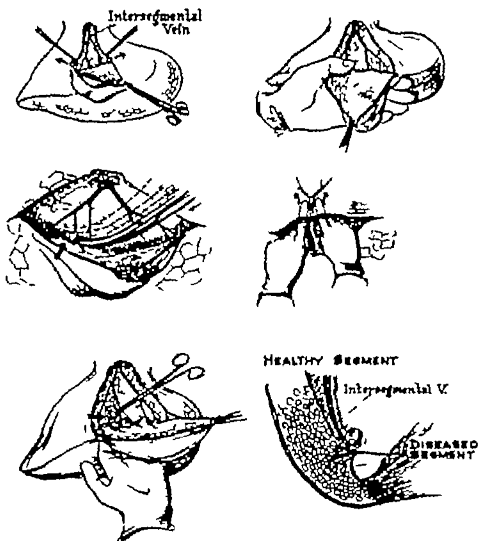


Fig. 40 (top left).—Dissection of intersegmental plane is facilitated by flattening the plane by divergent retraction of the edges and inflation of the lung.

Fig. 41 (top right).—As the plane is developed, counterpressure from the pleural surface aids dissection.

Fig. 42 (center left).—Side-to-side dissecting motion and division of a venous branch.

Fig. 43 (center right).—If tissues of the intersegmental plane are normal, segments can be separated cleanly by divergent motion of the fingers inserted along the intersegmental vein.

Fig. 44 (bottom left).—Alveolar damage and air leak. Counterpressure shown is incorrect. Note flat side of the hand in Figure 41.

Fig. 45 (bottom right).—Undue traction on venous tributaries may be transmitted to the normal segment with resultant parenchymal tears.

(Courtesy of Overholt, R. H. *et al.* J Thoracic Surg 19 207 225 February 1950.)

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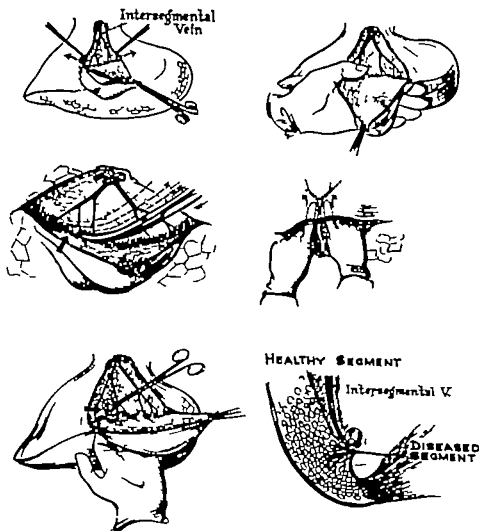


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Technic.—Exposure and gentleness are of paramount importance. Exposure is best obtained by irrigating the surface to keep

it free from blood and keeping it flattened out. Segmental margins can be gently retracted by divergent pressure at two opposite points (Fig 40) Inflation of the lung will flatten out the intervening surface Once the plane of dissection has been partially developed, counterpressure from the pleural surface at the level of dissection is of distinct aid in supporting the tissues during separation (Fig 41) The dissecting motion should be a side-to-side sweep between the intersegmental vein and its branches on the healthy side and the diseased tissue on the other side (Fig 42) The pressure is directed parallel to the plane rather than at right angles to it and may be accomplished with the rounded end of small curved scissors or the finger tip Small venous tributaries arising in the diseased segment and any fibrous strands are cut when found (Fig 42) It is simple and speedy to insert two index fingers along the central axis of the intersegmental vein to move the fingers divergently and to separate cleanly the two adjacent segments (Fig 43) If there is considerable fibrosis in the intersegmental plane, sharp dissection is necessary Damage to the lung surface is usually the result of digging in with the dissecting instrument or pulling on venous branches (Fig 44) Traction or pulling on the venous branches is transmitted to the tributaries entering from the normal segment these are anchored in torn alveolar tissue and air leaks result (Fig 45)

Of 28 patients operated on from September 1948 to February 10 1949 10 had two segments removed and 18 one Often these operations were combined with lobectomy In 15 patients the lung was completely re-expanded and the catheters were removed within 24 hours, in 10 within 48 hours and in 2 on the third and fifth days. Average postoperative hospitalization was 14 days There were no empyemas, two minor fistulas and one death from pulmonary insufficiency aggravated by inability to raise the bronchial secretions

Bilateral Bronchiectasis Analysis of 43 Consecutive Cases is presented by G E Lindskog and R D Alley[7] (Yale Univ) In approximately 80 per cent of patients, bronchiectasis is bilateral. Resection is the only known method for permanent and total cure Patients in this series ranged in age from 9 to 66 years, and 13 were females Operation was not advised in 17 because of extensive involvement, advanced age marked emphysema or heart disease

Bilateral resection has been completed in 12 and 8 have undergone unilateral resection. Treatment involved removal of 49 lobes in 33 operations Of those having bilateral op-

(7) Arch. Surg. 60:465-472 March, 1950

erations, six have a slight cough with little or no sputum, two are entirely symptom free and four have minimal symptoms. Unilateral operation resulted in improvement in seven, one is no better and none is symptom free Additional procedures are planned for three in the bilateral group and five who have had unilateral operations

Individual ligation technic was used in 24 total resections and mass ligation for 9 subtotal resections. Since penicillin became available it has been given pre and postoperatively and 100,000 units is left in the pleural cavity at the end of operation. Average postoperative period for subtotal resection patients was 68 days and for total resection patients 25½ days Subtotal resection was followed by bronchopleural fistula in six, empyema in seven, atelectasis in four and pneumonitis in three Total resection was followed by bronchopleural fistula in 3, atelectasis in 14 and pneumonitis in 4 There were no operative, hospital or late deaths in either group

Surgical Treatment of Bilateral Bronchiectasis Frederick G Kergin[8] (Univ of Toronto) analyzed 58 patients, 27 of whom had unilateral and 31 bilateral operations A total of 94 excisions were done with 4 deaths, an operative mortality of 4 per cent and a patient mortality of 7 per cent. The four deaths followed operation on the second side, a mortality of 13 per cent for bilateral operations The deaths all occurred among the first 13 patients The last 18 consecutive bilateral resections were completed without a death. Forty-eight patients were aged 14-43 (average 22) The other 10 were aged 4-14 (average 10) The four deaths occurred in the older group The younger patients, particularly the children, stood extensive resection better than the older persons but no definite conclusion was reached regarding the age limit for bilateral resection.

Fifteen patients showed pronounced disproportion in the distribution of the disease, in that it was slight on the second side All but one of these patients had unilateral resection with satisfactory results In the other 43 the disease was severe or moderately severe on both sides. Within certain limitations, staged bilateral resection is recommended for this group It was carried out in 31 patients (Fig 46)

(8) J Thoracic Surg. 10:257-269 February 1950

Of the hazards associated with surgery, cerebral anoxia is the most important. It is most likely to occur during or immediately after operation on the second side In prevention of anoxia there are two *general considerations* (1) to develop maximal respiratory function before operation and (2) to protect that function by preventing bron

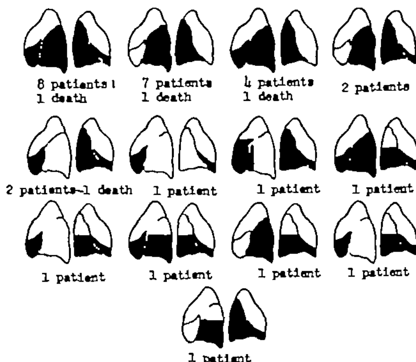


Fig. 46 —Diagrammatic representation of 31 bilateral resections. Black areas indicate resected lobes or segments. (Courtesy of Kergin, F G. J Thoracic Surg. 19 257 269 February 1950)

chial obstruction. Continuous observations of arterial oxygen saturation were made with an oximeter during operation in all cases On two occasions operation was abandoned after freeing the lobe because of inability to correct anoxia. However in each case the operation was completed satisfactorily at a later date

In 18 of the 27 patients who survived bilateral resection, the final result could be assessed All showed remarkably little evidence of *decreased respiratory* function and 15 were symptom free

Segmental resection of the basic divisions of the lower lobes, with preservation of the superior segment, has been

abandoned because of the high incidence of pleural complications and a tendency to development of bronchiectasis in the previously healthy superior segment.

[When dealing with bilateral bronchiectasis it is very important to consider the individual case rather than to follow any set rules. It is often much wiser to leave a lobe with minimal or moderate bronchiectasis than to strive for a perfect result. In other words, just because there is x-ray evidence of bilateral bronchiectasis it is not always wise to submit the patient to a bilateral operation. Not only is the operative risk greater in the bilateral case but also there is a greater danger of making a respiratory cripple of a patient who is subjected to the removal of a lobe of each lung. —Ed.]

Surgical Management of Chronic "Spontaneous" Pneumothorax Report on Etiologic Factors and Surgical Treatment Employed in 15 Cases is made by Lyman A. Brewer, III, Frank S Dolley and Byron H. Evans[9] (Los Angeles) Failure of the collapsed lung to re-expand after an attack of spontaneous pneumothorax may result in chronic invalidism, and persistence of the pneumothorax may be a major contributing factor in a fatal outcome In this study only apparently healthy persons with chronic and recurring pneumothorax treated by surgery were included.

Direct observation at open thoracotomy (13 cases) or by thoracoscopy (2 cases) showed some sort of cyst, subpleural bleb or bulla to be responsible for spontaneous pneumothorax in all but 1 case These findings are supported by other experiences reported in the literature Ruptured congenital cysts caused spontaneous pneumothorax in three cases, ruptured localized subpleural blebs or bullae (which may be a complication of old healed subclinical pulmonary tuberculosis) in eight and acquired blebs in association with generalized pulmonary emphysema in four

Failure of the lung to expand once an attack of spontaneous pneumothorax occurs may be attributed to intrapleural adhesions, ruptured congenital cysts which because of their epithelial lining fail to heal, scar tissue in wall of bullae, and visceral pleural membrane In seven cases a firm visceral pleural membrane was found to limit expansion of the lungs This membrane may be formed on visceral pleura as a result of fibrin deposition from the pleural effusion that occurs in some of these cases Microscopic examination shows the membrane to consist mostly of fibrovascular tis-

(9) J Thoracic Surg. 19 167 198 February 1950

sue The membrane may remain as a separate layer as long as there is no infection in the pleural cavity or subpleural lesion in underlying lung

If the lung remains collapsed for more than three months after a spontaneous pneumothorax, active therapy should be instituted In most reported cases sterile artificial pleuritis has been produced by means of irritants introduced into the pleural cavity However, because of the mechanical nature of the condition, surgical treatment will best preserve maximal pulmonary function. Surgical measures include closed catheter drainage, phrenic paralysis, thoracoscopy with internal pneumonolysis and thoracotomy Closed catheter drainage is useful mainly for acute and subacute forms of spontaneous pneumothorax. Phrenic paralysis relaxes the diaphragm and decreases tension on the lung to permit the pulmonary aperture to heal but it is probably less desirable than a more direct method of treatment. Stringlike adhesions, when present, may be divided by internal pneumonolysis with resultant successful expansion. Thoracotomy should probably be used as a primary procedure after the chest is opened complete pneumonolysis, surgical closure of the pulmonary opening, resection of the pulmonary cyst or bullae or decortication of the lung may be performed as indicated

METHODS —In preparing patients for operation the usual measures used for pulmonary resection should be instituted. The posterolateral approach is employed for the thoracotomy, using intratracheal anesthesia. After opening the pleural cavity sterile saline is introduced to determine the source of pulmonary rupture much as one would examine a bicycle tire for a leak. The site of rupture is instantly obvious when the anesthetist administers intrabronchial positive pressure. After complete pneumonolysis, simple resection is used for peripheral lesions, clamping the lung and closing the pulmonary tissue with mattress sutures of fine silk. Large thin walled cysts should be opened widely and resection performed with tension on the cyst wall lung tissue may be conserved by accurate identification of attachment of the base of the cyst to lung Segmental resection is infrequently indicated, and lobectomy is contraindicated if pulmonary tissue is to be conserved Removal of all blebs is often technically impossible and only those which look as though they might rupture at some future date need be resected Decortication is performed, if necessary according to the standard technics for clotted hemothorax. The lung is carefully checked for bronchial fistula before closure. Tiny parenchymal bubbling coming from the

decorticated normal lung is not serious and will be taken care of by drainage tubes inserted in the second or third intercostal spaces anteriorly and the sixth or seventh posteriorly and connected immediately to a closed drainage system Postoperative care is similar to that of a lobectomy, but the postoperative course is milder Penicillin may be administered through the anterior drainage tube daily for two to three days, with the posterior tube clamped for six hours after each injection Drainage tubes are removed on the third or fourth day, since the lung has expanded and they cease to function.

In this series only surgical treatment was employed, there were no complications except for a momentary cardiac arrest which occurred during operation In five cases decortication was followed by rapid expansion of the lung There have been no recurrences and no deaths

Intracavitary Suction (Monaldi) in Treatment of Emphysematous Bullae and Blebs in nine cases is reported by Jerome R Head and Edward E Avery[1] (Chicago) Although the surgical treatment of emphysematous blebs and bullae has been considered hopeless in the past, patients with bullous emphysema are being seen with increasing frequency

Thoracoscopy revealed that in bullae the destructive force is that of expiration instead of inspiration, with intracavitary pressures on coughing as high as 50 mm Hg Most patients' complaints are referable to chronic bronchitis or asthma.

The three stage Monaldi drainage method was found superior to thoracentesis, thoracoplasty or lipiodol* injections, especially in poor surgical risks

TECHNIC.—Several oblique and lateral x ray views are taken Films are exposed a few kilovolts lighter than normally because of the decreased density of lungs in these cases. The point of optimal drainage is chosen by selecting a site at which the bleb is adjacent to the chest wall. Under local anesthesia, an extrapleural exploration is done and pleural symphysis is produced with gauze packing Later the packing is removed and the wound allowed to heal. Pressure readings are taken, thoracoscopy is done and biopsy is performed if possible. A multiple fenestrated catheter is then placed well into the cavity, sealed at the skin edges with an airtight dressing and connected to a water-seal bottle. If air continues to escape through the bottle and the lung shows no evidence of re-expansion after a few days, a Stedman suction pump is added and adjusted to maintain a negative pressure of —10-20 cm. water Re-expansion occurs

(1) J Thoracic Surg 18:761 776 December 1949

in one to three weeks but the catheter is left in place a few more days to cause inflammatory obliteration of the space.

Three of the authors' cases follow

Case 1.—Man, 50, *had* chronic severe dyspnea, acute abdominal distention and a history of asthma and chronic appendical abscess. At exploratory laparotomy, adhesions were cut to relieve a small bowel obstruction. Postoperatively, intracavitary suction was performed, re-expansion of the left lung occurred in 10 days. The right lung was similarly treated with a resulting increase in vital capacity from 950 to 3,550 cc. The patient was no longer bedfast with dyspnea.

Case 6.—Man, 68, had had progressive dyspnea for 20 years. After an extrapleural pack was inserted, he became more cyanotic and sank into coma. Decompression was complicated by a tension pneumothorax requiring drainage. Re-expansion occurred in one month. Subsequently, the patient was active about his home.

Case 7—Boy, 10, was admitted because x rays revealed he had no left lung markings. Drainage was complicated by sepsis after insertion of the catheter and was attributed to a possible epithelium-lined cyst. This could have been avoided by careful thoracoscopy and *biopsy of the wall.*

Cavernous Hemangioma of Lung James H. Forsee, Hugh W Mahon and L. A. James[2] (Fitzsimons Gen'l Hosp., Denver) report a typical case in which a diagnosis of pulmonary tuberculosis was first made This condition is characterized by appearance in a young adult, *cyanosis*, clubbing of the fingers and toes, polycythemia, normal heart, obscure lung tumor or infiltration, and often a murmur over the involved portion of the lung There is occasionally a family history of hemorrhagic telangiectasia.

Youth 20 with an area of infiltration in the right upper lung field, was being treated for pulmonary tuberculosis with no improvement in the lesion. On the suggestion of a physician that the lesion was probably not tuberculous but vascular an angiocardiogram was made. It showed an arteriovenous shunt in the right lung with slight dilatation of the pulmonary artery Valsalva's test indicated that the lesion was of vascular origin. On the basis of these studies and presence of cyanosis and clubbing of the fingers, exploration of the right thoracic cavity was done. Massive large venous dilatations were seen on the posterior surface and near the interlobar fissure of the right upper lobe. Lobectomy was done, with immediate improvement in the cyanosis of the face. Cyanosis of the fingers and hands completely disappeared in two months.

Microscopically, the surgical specimen comprised a nonencapsulated cavernous hemangioma composed of groups of dilated, thin

(2) Am. Surg. 131 418-422 March, 1950

walled blood spaces. The cyanosis, and also polycythemia which had been present, were apparently due to an arteriovenous fistula. It was not formed by direct junction of artery with vein but indirectly through the cavernous angiomatous spaces in the posterolateral segment of the right upper lobe. There was no evidence of tuberculosis.

[Patients with this condition are being found with increasing frequency. Sometimes the lesion is bilateral. The result of the operation is most dramatic, and the cyanosis usually disappears immediately.—Ed.]

Granuloma—Tuberculosis

Surgical Lesions of Pulmonary Coccidioidomycosis S. J. Greer and John B. Grow[3] (Denver) state that the commonest complication of this disease is formation of a cavity, this occurs in 4-6 per cent of the acute cases severe enough to cause the patients to seek medical attention. Cavitation persists after the acute phase has passed but is asymptomatic. Most cavities close in three to six months if activity is curtailed. Even if the cavity remains patent, the patient may return to normal activity without ill effects and the cavity will usually close eventually. Occasionally, hemoptysis develops but is usually minimal and has been treated successfully by pneumothorax. The operation, however, is of little value in promoting cavity closure. Surgery is rarely indicated, and only a few operations have been reported in the literature. The authors describe 10 cases with unusual complications for which surgery was indicated: six lobectomies and four decortications were performed.

Four lobectomies were done because of symptoms associated with pulmonary cavitation for 14, 35, 36 and 62 months, respectively, and hospitalization for an average of 12 months. The chief complaint was weakness, easy fatigue and dry chronic cough. Three patients had mild hemoptysis frequently, three were underweight and failed to gain weight during hospitalization, two had chronic low grade fever and two had chest pain of pleuritic nature. All symptoms but chest pain were promptly relieved by surgery. One lobectomy was performed on a patient with a cavity 6-8 cm in diameter, a fluid level in one lung and a small round lesion in the other lung which remained un

(3) Dis. of Chest 16:334-353, September, 1949.

changed after operation The other lobectomy was done because of a solid tumor in the left upper lobe which was diagnosed as a coccidioidoma postoperatively

The four decortications were performed because of non expansile lung following spontaneous pneumothorax. Diagnosis of coccidioidomycosis had been made in three cases before collapse of the lung, cavitation was present in all three, and a bronchopleural fistula was demonstrated at operation In the other case the cause of the spontaneous pneumothorax was not found but Coccidioides immitis was isolated from the pleural fluid There was incomplete expansion of the lung in two patients an apical thoracoplasty was done on one, and the other refused further surgery, both are doing well

The mycelial form of C immitis was identified in four of the five patients having lobectomy for cavitation.

Surgical Therapy of Pulmonary Tuberculosis at Veterans Administration Chest Center Ralph Friedlander and William M. Chardack[4] (Castle Point, N Y) selected for review the period from March 1947 to March 1948 during which 145 major procedures were carried out without mortality The complications encountered were five tuberculous spreads and one each of tuberculous wound infection pyogenic wound infection (abscess) cardiac decompensation and wound disruption.

Open pneumonolysis is recommended, in preference to wide decollation by the closed method, for bilateral disease in which control of one side appears mandatory In two cases a pneumothorax space was created surgically though the procedure was satisfactory from the clinical viewpoint in one case in the second the type of lesion made it resistant to pneumothorax. In 53 cases adhesions complicated an otherwise desirable pneumothorax In 39 these were sectioned by the closed method and in 3 by the open method in 11 thoracoscopy was merely exploratory and re-expansion was recommended

A total of 108 thoracoplastic operations was performed A variation in the technic deserves mention In about half the cases the transverse process of the first rib was left in in a second group this process was removed There is no

(4) Dis. of Chest 16 197 212 August 1949

additional technical difficulty, and the resulting anatomic collapse compared favorably with that in the first group X rays show that regeneration of the bony plate sets in closer to the spine, and the gutter between spine and bony plate fails to develop The upper portion of the lung seems anatomically better collapsed Streptomycin was used pre and postoperatively in alternate cases, incidence of post operative spreads was definitely higher in the nontreated group In treatment of pulmonary lesions the greatest value of the drug is in conjunction with surgical procedures de signed for collapse or removal of diseased parts But about 60 per cent of treated patients seem to develop resistance to the drug and after 60 days it seems that resistance must be expected regardless of dosage Attention is drawn to the fact that in some cases it is best to keep the antibiotic in reserve for a late stage of therapy In the thoracoplasty series there have been a number of giant cavities some with marked sputum production. A somewhat different approach was used satisfactorily thoracoplasty in reverse order, i.e., from below upward will close a higher proportion of these cavities.

Twelve resections were performed without mortality All patients were given streptomycin for one week pre operatively and for 60 days postoperatively The only com plication was a contralateral spread in a pneumonectomy Resection was routinely followed by limited thoracoplasty procedures to avoid overdistention of the remaining paren chyma. General agreement has been reached as to the in dication of resection for isolated tuberculoma, thoraco-plasty failure and uncollapsible lower lobe cavity, also when severe bronchostenosis is present and thoracoplasty is therefore contraindicated The difference of opinion now centers on the group of so-called predicted thoracoplasty failures, i e., the group of cases of destroyed lungs in which there is a great amount of disease but no severe broncho-stenosis The authors are inclined to recommend that thora coplasty be done first, to be followed later by resection if conversion is not obtained.

There were 14 thoracoplasty failures. Ten patients were treated by a modified type of thoracoplasty revision com bined with open intrapleural freeing of the lung and fixa

tion of the apex in a lowered position by some plastic procedure using a pleural flap or a muscle transplant taken from the pectoralis group Of the remaining four, one elderly patient was treated by cavernostomy and three were treated by resection and made uneventful recoveries Thus, *of the 14 patients, 10 ultimately had a good result* with complete conversion of sputum, 2 were improved but the disease was not completely arrested, 1 was improved by cavernostomy and in 1 operation was too recent for the result to be classified

[An additional reason for performing a thoracoplasty after a pneumonectomy for tuberculosis is that such a procedure diminishes the risk of tuberculosis empyema, a complication which sometimes occurs.—Ed.]

Phrenic Nerve Paralysis Special Consideration of Accessory Phrenic Nerve Winfield O Kelley[5] (Norwich, Conn.) reports that in 75 7 per cent of 309 cases at tuberculosis sanatoriums there was at least one accessory phrenic nerve If allowed to remain intact, an accessory phrenic nerve may permit the diaphragm to function. To avoid this situation specific points in technic of practical importance are stressed.

Method.—The patient is placed in the supine position with the head turned away from the side of operation and a small pad under the back of the neck. A good view of the anatomic structures posterior to the clavicle may be obtained if the operator stands at the upper end of the table and gazes downward into the depths of the incision. A metal ring held in a horizontal position just above the patient's head by an upright bar fastened to the corner of the operating table holds the drapes away from the patient's head and gives the surgeon adequate working room. The usual phrenic incision is made, and the phrenic nerve is isolated, infiltrated with novocain* and crushed. *The anterior and medial aspects of the scalenus* anterior should be explored for a second phrenic trunk. The operator should then move from the side to the head of the table. A portion of the brachial plexus is exposed by dissection along the lateral border of the scalenus anterior The accessory phrenic nerve can be found as it leaves the fifth root of the plexus and proceeds downward and somewhat medially If the accessory phrenic nerve is found at a rather low level, the brachial plexus should be retracted The accessory nerve may often branch as a Y, the lateral branch going to the subclavius muscle and the medial eventually joining the main phrenic trunk a few centimeters below the level of the clavicle. A portion of the branching nerve for a distance of about 1 cm. is excised. *Other accessory nerve fibers may be found at higher or*

(5) J Thoracic Surg. 19 923-926 June, 1950

lower levels and should also be excised. After closure of the incision fluoroscopic examination should be performed, and, if the leaf of the diaphragm on the side of operation is moving, the neck should be re-explored at once. In most instances another small accessory phrenic nerve will be found extending medially from the brachial plexus at a very low level beneath the clavicle

In the most satisfactory test for determining diaphragmatic motion the patient inhales deeply while the observer presses his two hands against the lower portions of the ribs and watches the diaphragm fluoroscopically A paralyzed hemidiaphragm will not move downward during this maneuver

Surgical Treatment of Round Tuberculous Pulmonary Lesions (Tuberculomas) Hugh W Mahon and James H. Forsee[6] (Fitzsimons Gen'l Hosp) define tuberculoma as a type of fibrocaseonodose tuberculosis in which one nodule is roentgenographically prominent because of size, sharp outlines and lack of surrounding parenchymal infiltration. In 48 cases tuberculomas were found in any portion of either lung but were most frequently subpleurally located. It is generally accepted that the pulmonary tuberculoma, excluding the Ghon nodule, is a reinfection lesion acquired by the aerogenous route. Serial x rays of 18 patients have shown that tuberculomas may develop from rather extensive tuberculous caseous bronchopneumonia, caseous lobular or broncheolar tuberculous pneumonia or tuberculous bronchopneumonia which proceeds to cavitation. Eventually the periphery is composed of concentric layers of fibrous tissue with some hyalinization, but the central portion shows varying degrees of liquefaction, calcium deposition and cavity formation which may appear on x rays as irregular, concentric slits.

There are several good reasons for removal of these nodules They do not respond to medical treatment, including streptomycin They may persist for years apparently unchanged and then cavitate and break the fibrous barrier with a resulting acute tuberculous pneumonic flare-up Use of every available diagnostic procedure may still not establish a correct diagnosis this can be obtained only by excision of the lesion followed by pathologic examination. Of 55 round solid lesions from the periphery of the lung, 48 were tuberculomas, 4 were malignant and 3 benign. Cure

(6) J Thoracic Surg. 19 724 740 May 1950.

is possible when the disease is confined to an area readily accessible to surgery The operative risk is low, there being no operative deaths in this series

Most tuberculomas are peripheral and subpleural with few or no adhesions to the parietal pleura The extent of the main nodule and the presence of satellite nodules usually can be detected on palpation. Surgical judgment must determine amount of tissue to be removed. A wedge excision is sufficient for the mature fibrocalcific tuberculoma but a segmental or total lobectomy may be necessary if the involved area is too extensive for a wedge resection. Enucleation should be avoided The danger of postoperative tuberculous pleuritis is slight and did not occur in this series. After seven and nine months, respectively, in two cases signs and x ray evidence of a tuberculous process developed in another lobe Lobectomies were performed in both.

[There is every reason why these solitary spherical lesions should be explored. One of the main reasons is that usually it is impossible from the x ray appearance to differentiate between a tuberculoma and a carcinoma. In our own experience at the Barnes Hospital we find that about 50 per cent of these lesions are carcinoma. But, as the authors state, even if the lesion is a tuberculoma it should be removed anyway—Ed.]

Monaldi Drainage Valuable Adjunct in Surgical Treatment of Pulmonary Tuberculosis Warriner Woodruff and Carl G Merkel[7] (Saranac Lake, N Y) used this procedure as occasion demanded for eight years in the treatment of 114 cavities in 102 patients In general, the procedure was integrated with over all treatment of the disease It was used alone only in those patients with far-advanced and otherwise hopeless disease in which the palliative effect of reducing cough expectoration and toxicity made the patients remaining days more comfortable However in several instances improvement was sufficient to justify thoracoplasty or excision or both. For these patients, it was truly a lifesaving procedure It was found extremely valuable in giant cavities as a preliminary to thoracoplasty The decrease in cavity size made a smaller collapse possible and more effective

In 54 instances the contralateral side had cavity, empyema, unexpanded pneumothorax or permanent collapse

(7) New York Stat J Med 50 201 206 Jan. 15 1950

grafts Gradually the boundaries of the cavity become lined with skin which grows out to meet the skin on the surface of the chest wall The cavity thus becomes obliterated, leaving a defect in the chest wall

In one patient who died several months after this treatment was completed, autopsy disclosed that skin had covered the defect and that there was no evidence of an open bronchus leading to the skin surface In two other cases skin grafting has been successful and the cavities seem to be healing

Use of Polyethylene in Extrapleural Pneumonolysis in 21 patients is reported by William B Condon and Fred R Harper[9] (Denver) The posterior approach was used most frequently because better exposure is obtained than by the axillary or anterior route A sufficiently long straight paravertebral incision is made to allow enough mobilization of the scapula so that a 3 or 4 in. segment of the third or fourth rib may be removed. The cleavage plane separating the parietal pleura from the chest wall in the endothoracic fascia is developed under direct vision. Usually, the extent of the tuberculous process necessitates complete mobilization of the apex of the lung and separation of the parietal pleura from the mediastinal structures inferiorly to the aortic arch or the azygos vein. Originally, a single large pack of fluffed up film was roughly molded by hand into the general desired shape and inserted, but this type of pack shrinks somewhat during the following months Now the cavity is lined with a thin sheet, then filled with long strips of the film to form a firm but resilient pack.

The authors have limited use of the procedure largely to patients in whom thoracoplasty was inadvisable, i e., aged persons (the oldest was 65) patients with pre-existing contralateral thoracoplasty and those whose pulmonary function precluded the less specific collapse afforded by thoracoplasty There have been no deaths, severe operative complications, clinical infection of the extrapleural space, erosion of an adjacent structure or shifting of the pack.

Clinical use of polyethylene film has several advantages. The film can be made to fill completely the irregularities of the space The pack can be made of any degree of hard

(9) Arch. Surg 59 705 709 September 1949

ness It is easily sterilized and handled and requires no special instruments It may be sutured to maintain correct position. The pack also may be removed without difficulty after it had been in place for nine months in one patient, the cavity looked as though it had just been created and showed no grossly visible reaction of any type and the pack itself was unchanged

Pulmonary Resection in Tuberculosis Correlation of Clinical Indications and Pathology Y Fred Fujikawa and Lauren V Ackerman[1] (Missouri State Sanatorium) report on treatment of tuberculosis in 25 patients with pneumonectomy and in 9 with lobectomy Preoperatively electrocardiograms and exercise tests were utilized to evaluate the cardiac reserve In certain instances streptomycin was used pre and postoperatively Most operations were performed with the aid of epidural anesthesia, and the posterolateral approach was used in all. Hilar structures were ligated individually interrupted sutures used to close the bronchial stump and hilar structures pleuralized. Between four and eight weeks postoperatively a modified thoracoplasty was performed to obliterate pleural space in all except patients with lower lobectomies in whom the space was obliterated by phreniclasis at the time of operation. The patients were treated in bed for three months after resection, gradually given more exercises and discharged as having arrested cases 12 or 13 months after operation.

All but four patients had positive sputum at the time of surgery There were nine deaths, all in pneumonectomy patients Deaths occurred within 24 hours in two up to 90 days later in two and after longer periods in the others. Early postoperative spread developed in two and new infiltrations in four patients 7 10 months after operation. Four patients had bronchopleural fistulas. The incidence of empyema was 9 4 per cent. Five of the nine lobectomy patients are classified as having arrested disease and have been discharged in two the disease is quiescent with negative sputum in one it is quiescent with occasionally positive sputum, and one is roentgenographically negative 27 months postoperatively Of the 16 living pneumonectomy patients, 10 have been discharged with the disease arrested,

(1) Dis. of Chest 16 543-559 November 1949

1 is on exercise preparatory to discharge, in 4 the disease is quiescent with negative sputum, and in 1 it is quiescent with positive sputum.

Bronchostenosis, tuberculous bronchiectasis, destroyed lung with cavitation, lower lobe cavities and thoracoplasty failures, all selected mainly on the basis of x ray, bronchographic and laboratory evidence, were regarded as indications for resection Tuberculomas and tension cavities are generally accepted indications for resection, but there were no cases of this type in the series

Three patients had bronchostenosis all these had positive sputum, previous thoracoplasties and bronchographic evidence of bronchiectasis distal to the stenoses. Two patients, each with high grade bronchostenosis, were operated on because pneumothorax had failed. Bronchostenosis is probably the most widely accepted indication for resection in pulmonary tuberculosis

Diagnosis of tuberculous bronchiectasis as a clinical indication for resection in this series was applied to patients with x ray evidence of bronchiectasis and a positive sputum. Endobronchial tuberculosis in the ectatic bronchi ranged from an isolated tubercle ulceration into a bronchus, to partial and complete obstruction of the bronchial wall with obstruction and stenosis. In 11 patients bronchiectasis was limited to the upper lobe and only 1 had moderately extensive endobronchial disease, the others having predominantly nonspecific bronchiectases. In 11 other patients bronchiectasis occurred in the middle and/or lower lobes, and 6 had moderate to extensive bronchial tuberculosis. *Most endobronchial tuberculosis is secondary to a parenchymal focus and may reach the bronchus by direct implantation direct extension or lymphatic or blood stream spread* Four patients had tuberculous bronchiectasis without cavitation. In three tuberculous bronchiectasis occurred without cavitation but with atelectasis and fibrosis. Five patients had bronchographic evidence of bronchiectasis and positive sputum after thoracoplasty In all, the lesions for which thoracoplasties were performed were apparently controlled, but bronchiectasis was present on that side Two patients had insufflated cavities when pneumothorax was begun this was subsequently *abandoned and thoracoplasty*

performed, to be followed by empyema and bronchopleurocutaneous fistulas and bronchiectasis Pneumothorax resulted in effusion in one patient, and since the collapse did not control the disease or convert the sputum, and there was bronchiectasis resection was performed. Cavitation, positive sputum and bronchiectasis of the lobe in which the cavity was located were associated in four patients, and in three more these findings existed with atelectasis and mediastinal retraction to the affected side

Destroyed lung with cavitation was treated by resection in one patient Histologic examination of the specimen showed extensive endobronchial tuberculosis bronchiectasis, persistent cavity encapsulated caseous foci, atelectasis and fibrosis. In two patients lower lobe cavities were treated by resection Residual cavitation and bronchiectasis occurred in two patients after thoracoplasty which was regarded as a failure, necessitating resection. In two patients preoperative diagnosis was incorrect examination of the surgical specimens revealed hitherto unsuspected tuberculous lesions

MALIGNANCY

Tobacco Smoking as Possible Etiologic Factor in Bronchogenic Carcinoma Study of 684 Proved Cases is presented by Ernest L. Wynder and Evarts A. Graham[2] (Washington Univ) Patients were from areas representing a fairly good cross section of the United States. Almost all were personally interviewed to obtain information for a detailed questionnaire Microscopic confirmation of the presence of carcinoma was obtained in all cases A control group consisted of 780 hospitalized patients without cancer of the lungs called the general hospital population.

The data reflect the results of many previous studies There was no essential difference in amount of smoking between the general hospital population and patients with diseases of the chest who did not have cancer

There were 605 men with bronchogenic carcinoma other than adenocarcinoma 96.5 per cent were moderately heavy to chain smokers for many years, compared with 73 7 per cent of the general male hospital population. Percentage

(2) J A M A. 143 329 336 May 27 1950

of nonsmokers in the two groups were 1.3 and 14 6, respectively Among the cancer group 86 4 per cent were heavy to chain smokers and 51 2 per cent excessive or chain smokers, corresponding figures among the general hospital group were 54 7 and 19.1 per cent Only 2 per cent of the incidence of lung carcinoma is found in male nonsmokers or minimal smokers

In general, patients with cancer of the lungs in their forties and early fifties have smoked more heavily than older patients with this disease This observation does not seem to apply to the few patients in their thirties. The frequency of nonsmokers among patients without cancer is significantly different from that of patients with cancer in the same age group

Over 96 per cent of patients with cancer of the lungs had smoked for more than 20 years, and 85 per cent had smoked for 30 years or more There may be a lag of 10 years or more between cessation of smoking and occurrence of clinical symptoms of cancer Most cancer patients were cigaret smokers rather than pipe or cigar smokers the ratio being higher than that in the general population. The higher incidence of lung cancer in cigaret smokers may result from the more frequent inhalation of cigaret smoke than of pipe or cigar smoke the presence of greater amounts of certain irritative substances in cigarets or the greater physical and economic convenience of cigaret smoking leading to heavier smoking

Tobacco seems to play a similar but less evident role in induction of epidermoid and undifferentiated carcinoma in women. Ten of the 25 patients were nonsmokers. Incidence of the disease among men may be greater because few women have smoked for long periods. The influence of tobacco on the development of adenocarcinoma seems much less than it is in other types of bronchogenic carcinoma. In general, the less a person smokes the less are the chances of cancer of the lung developing and the more heavily a person smokes the greater the probability of this disease

Silent Phase of Cancer of Lung Richard H. Overholt and Ivan C Schmidt[3] (Tufts College) found that 10 months usually elapses after onset of symptoms before cancer of

(3) J A M A 141:817-821 Nov 19 1949

the lung is diagnosed. The average patient waits three months after onset before seeking advice and the remaining time is used by physicians to sort out those with cancer from those with other disorders

Cancer of the lung has a silent phase and is detectable. Air in the expanded lung provides a natural, ever present contrast medium for the detection of density changes. Small tumors in the periphery cast a direct shadow and smaller tumors centrally located cause a subsegmental or segmental bronchial obstruction which casts a shadow of the corresponding atelectatic segment (Figs 47 and 48) A case

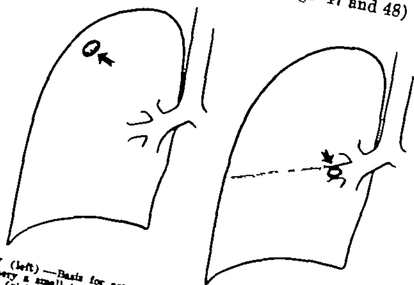


Fig. 47 (left) —Basis for asserting that a roentgenogram shows silent cancer. In the periphery a small tumor casts a direct shadow in contrast to rarified lung field.

Fig. 48 (right) —In stem bronchus a small tumor casts a shadow of segmental or subsegmental atelectasis. This shadow is therefore indirect, yet it greatly magnifies the actual size of the tumor

(Courtesy of Overholt, R. H., and Schmidt, I. C. J. A. M. A. 141 817 821 Nov 19 1949)

finding program for tuberculosis performs a double service, as the incidental finding of silent cancer has shown. Since rates of cancer growth vary, abnormal shadows have been apparent for several years in rare instances and on surgical exploration an apparently localized lesion has been found. However exploratory operations in cases of silent lesions have also been known to reveal extensive metastases. This in no way mitigates the value of screening but it is impossible to say how often patients should be screened to

give reasonable protection from cancer of the lung For the present, selective screening on an annual basis would seem wise The highest yield will be among men over age 45

While screening the whole population and spotting abnormal pulmonary densities is the first step, prompt and adequate investigation of suspects is equally important. This may be accomplished by positional, stereoscopic, and tomographic x ray studies, cytologic examination of sputum, bronchoscopy or exploratory thoracotomy Negative results from the first three methods do not prove the nonexistence of cancer and surgical exploration should be advised. With the chest open, direct biopsy of lesions near the surface and many in the hilar area is possible If the lesion is centrally located and direct biopsy is not technically easy then the segment or subsegment bearing the mass should be removed. If the identity of the lesion is known before exploratory operation or diagnosis has been established at surgical exploration, total resection of the lung and unilateral dissection of the mediastinal lymph nodes should be carried out.

Cytologic Diagnosis of Bronchogenic Carcinoma. Lewis B Woolner and John R McDonald[4] (Mayo Clinic) examined sputum or bronchial secretions of about 3 000 patients and made a cytologic diagnosis of carcinoma in 320 In 89 of the last 150 patients with positive cytologic evidence of carcinoma, final diagnosis of bronchogenic carcinoma was established by tissue section. Tissue was not obtained from 55, and diagnosis was based on clinical and x ray evidence such as metastases to bone or lymph nodes, fixed vocal cords, pleural effusion, Horner's syndrome, superior vena cava obstruction or the gross appearance at bronchoscopy Carcinoma was found in the breast, rectum, prostate or uterus of four patients, so that the pulmonary lesion was probably metastatic One patient had carcinoma of the hypopharynx. In one case the cytologic diagnosis was small cell carcinoma but histologic examination of the surgically removed right lung revealed only chronic pneumonitis About 40 per cent of all patients with positive cytologic smears underwent surgical exploration with smears as the only preoperative microscopic evidence of cancer

(4) Am J Clin Path 19 765-769 August 1949

To determine the incidence of cases missed (false negatives) by routine cytologic studies, records were studied of 488 patients in whom cytologic results were negative during the period covering the last 100 cases with positive results Proved or strongly suspected bronchogenic carcinoma was missed on routine cytologic examination in 47 At least two specimens of sputum or bronchial secretion from most of these patients were examined. Since 147 patients had proved or suspected bronchogenic carcinoma during this period and 100 were reported positive by routine cytologic examination, it may be said that 68 per cent of the lesions were detected by this method.

[It should be emphasized that the identification of cancer cells in the sputum and bronchial washings must be made by an expert. It is not always easy to be sure whether or not one sees cancer cells. The percentage of positive results (68) stated by the authors is about the same as that noted by other observers. The procedure is unquestionably a valuable auxiliary method in the diagnosis of bronchogenic carcinoma.—Ed.]

Chronic Nonmalignant Pulmonary Lesions Simulating Bronchogenic Carcinoma. Kaare Liavaag[5] (Oslo) reports two cases of pulmonary tuberculosis two of chronic pneumonitis, one of innocent bronchial stenosis and one of bronchiectasis in which pneumonectomy was done because of presumptive diagnosis of cancer From this experience he concludes that, even if use is made of all modern diagnostic methods, there is still a number of cases in which definite preoperative diagnosis cannot be established and differentiation between nonmalignant lung lesions and bronchogenic carcinoma is difficult or impossible In these instances the following procedure is recommended

METHOD—Exploratory thoracotomy is performed. If diagnosis is still obscure, a biopsy specimen is taken during operation and the tissue examined by the frozen section method If this does not settle the problem, a lobectomy if technically possible, is performed and frozen sections made immediately If microscopic examination reveals cancer, the operation is continued and pneumonectomy performed if the patient's condition does not contraindicate it.

[For years we have used frozen sections in doubtful cases. They are of very great value.—Ed.]

Use of Interstitial Radon Seeds and Needles in Inoperable Lung Cancer Irving M. Ariel, Jerome R. Head, Hiram T Langston and Edward E Avery[6] (Veterans' Admin. Hosp, Hines, Ill.) report data on 17 patients *Three types of gold*

(5) Acta chir Scandinav 99:313-324 1950.
(6) Cancer 2 581 580 July 1949

seeds and radon needles were used Active lengths were 1 2 and 4 cm., over all diameter was 0 7 mm and the wall thickness 0 3 mm They contained an average of 1, 2 and 4 mc radon. The plan was to surround the lesion with the large needles and disperse the smaller tubes and seeds throughout the neoplasm according to the distribution proposed by Quimby However such accurate distribution was often difficult or impossible The elements were introduced with the ordinary seed inserters and remained permanently

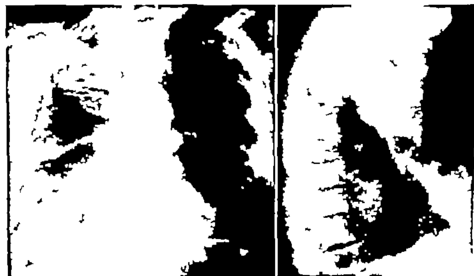


Fig 49 (left) —Anteroposterior film showing distribution of radon seeds and needles in neoplasm.
Fig 50 (right) —Lateral film in same case.
(Courtesy of Ariel I. M., *et al* Cancer 2 581 586 July 1949)

An attempt was made to provide 6-10 threshold erythema doses to all parts of the neoplasm (Figs. 49 and 50) Total doses varied from 2,660 to 15 864 mc. hr

The presence of radon had no deleterious effect on convalescence All patients had prompt though transient palliation (1 10 months) The severity of cough and amount of expectoration were decreased. Chest pains were diminished in all but one patient, in whom they were believed due to rib metastasis. In two patients atelectasis due to obstruction of the bronchus by tumor was relieved. General symptoms were abated in most patients, and appetite improved, with weight gain. In one patient roentgenography showed tumor size decreased from 6 5 to 3 5 cm. in diameter

in one month. Survival time was not influenced significantly 16 patients died of the disease an average of 5 6 months after therapy, 1 patient was alive and asymptomatic after 10 months. One patient who had good early palliation died four months after therapy owing to reactivation of a tuberculous lesion in the opposite lung The possibility that irradiation contributed to the reactivation cannot be excluded

The difficulty of securing correct distribution precludes use of this method if surgical cure can be anticipated. In small lesions inoperable because of location (carina, etc), external irradiation is preferable Multiple pulmonary or pleural metastases are also contraindications to treatment with interstitial radon Thoracotomy should not be performed for the sole purpose of inserting radon seeds and needles

Nitrogen Mustard in Treatment of Inoperable Bronchogenic Carcinoma. Joseph P Lynch, Paul F Ware and Edward A. Gaensler[7] (Boston City Hosp) treated 60 patients with nitrogen mustard only palliative results were anticipated. The usual dosage was 0.1 mg /kg body weight repeated for four consecutive days In some instances treatment was continued up to eight days, until a relative lymphopenia was noted in the blood smear All patients were hospitalized during treatment and for a varying period thereafter White blood cell and differential counts were done before treatment, daily during treatment and twice weekly for two weeks or longer after the last dose of nitrogen mustard. The drug was made up in 10 cc saline solution and the proper amount injected slowly intravenously or through the tubing of a saline infusion

Objective signs of improvement included decrease in sputum in 19 cases, decrease in size of primary tumor in 12, decrease in size of metastatic nodes in 11, relief of superior caval syndrome in five, clearing of atelectasis in 6 disappearance of convulsions in four and miscellaneous improvements in others Even more frequently patients were improved subjectively with marked decrease in cough, dyspnea and wheezing as well as decrease or complete relief of chest pain.

(7) Surgery 27 368 385 March, 1950

Patients with undifferentiated tumors showed excellent clinical response, whereas those with well differentiated tumors despite striking microscopic changes responded less often though in sufficient number to justify use of nitrogen mustard Objective improvement occurred in 83 per cent with undifferentiated tumors 50 per cent with squamous type 33 per cent with adenocarcinoma and 11 per cent with epidermoid tumors Effectiveness of nitrogen mustard generally follows the laws of radiosensitivity

Results could not be related to dosage however, larger doses were effective in some patients who did not respond to the standard dose Toxic reactions, such as gastrointestinal disturbances and lymphatic and bone marrow depression were encountered but caused no fatalities Gastrointestinal disturbances appeared to be unrelated to dosage or to clinical therapeutic results but leukopenia was definitely related to dosage and appeared to be of some prognostic significance Nitrogen mustard produced relief and comfort for many patients for a short time but usually did not prolong life

[We have found that some patients are made much more uncomfortable. For that reason we topped using nitrogen mustard two years ago.—Ed.]

THORAX—MEDIASTINUM

Tumors of Chest Wall. According to William B Condon and Fred R. Harper[8] (Denver) the commonest chest wall tumors are metastatic growths *Actinomycosis, tuberculosis* or herniation of the lung may resemble but should not be confused with chest wall tumor Skin tumors include sebaceous cysts *papillomas, hemangiomas or pigmented* moles. The most frequent subcutaneous tumors are benign lipomas and multiple neurofibromas Tumors of muscle or fibrous tissue include fibroma myoma and rhabdomyoma, any of which may have its sarcomatous malignant counterpart Tumors of the ribs are not uncommon and include chondroma, chondrosarcoma chondromyxosarcoma, giant cell tumor Ewing's tumor and myeloma

(8) Dis. of Chest 17 741 58 June 1950

A prominent group of chest wall tumors originate in nerve tissue A neurofibroma is a more or less slowly growing, usually benign tumor, frequently located within the posterior mediastinum and posterior thoracic cage Malignant tumors of nerve origin occur more often in children and young adults, grow with comparative rapidity and, when discovered, have already metastasized or infiltrated beyond the operative field Ganglioneuromas are retropleural tumors of sympathetic origin which contain chiefly nonmedullated nerve fibers with imperfectly developed ganglion cells. They are usually considered benign, but metastases have been reported. The neurofibroma is the commonest type of tumor originating in nerve tissue If an intrathoracic neurofibroma is found, a thorough search of the entire body should be made for similar lesions. Recklinghausen's disease, neurofibromatosis, often involves the chest wall tissues A neurofibroma originating from a spinal cord root may grow through the intervertebral foramen and continue into the chest This is aptly called the "dumb-bell type", the head grows intraspinally, producing symptoms typical of cord tumors, and the distal segment enlarges intrathoracically, usually without producing symptoms Most thoracic neurofibromas are within 2-3 cm. of the intravertebral foramen and are discovered by routine chest x rays. Despite their benign symptomless nature and slow growth, neurofibromas should always be removed.

Other chest wall tumors should be treated in similar fashion No tumor can be definitively diagnosed without microscopic examination. Growth cannot be regarded as terminated unless the tumor is completely separated from the body When the soft outer chest wall structures are involved, wide excision may be required. Sizable segments of two or more ribs and their accompanying intercostal bundles must be sacrificed for complete eradication of some growths In repairing such a defect complete chest wall stability should be maintained to avoid paradoxical respiration with its diminution in pulmonary function and loss of forceful coughing This may be accomplished by separating one or more adjacent ribs from their sternal ends and swinging them diagonally across the defect. Their divided ends and accompanying intercostal bundles should

then be anchored to another fixed structure of the chest wall. The successful use of a tantalum plate has been reported

Thoracic Diverticula Which Originate from Intestine. Robert E Gross Edward B D Neuhauser and Luther A. Longino[9] (Boston) report three cases of an anomaly not encountered in the literature In each there arose from the duodenum or jejunum a side arm that left the intestine at a right angle and coursed upward to the right crus of the diaphragm, which it pierced Parts of the structure had the diameter, thickness and appearance of an intestinal loop but in some places it ballooned out considerably The diverticulum always occupied a deep position behind the stomach or gastrohepatic ligament. It continued upward in an extrapleural location in the posterior part of the chest and rose to its apex. In the first case the structure was long enough to be coiled on itself, lying just above the diaphragm and to the right of the heart then it ran upward took a sharp angle to the left, ran behind the esophagus and aorta, turned upward and proceeded to the left apex (Fig 51) The diaphragmatic defect was large enough to permit herniation of several loops of ileum into the chest next to the diverticulum. In the other two cases the defect was small and its edges were firmly adherent to the diverticular walls. The diverticula had smooth muscle coats and were lined by mucosa resembling some portion of the alimentary tract. In the first case the lining was similar to that of the jejunum colon and respiratory tract in the other two it resembled gastric mucosa and secreted hydrochloric acid and pepsin.

In one case accumulation of gas or material in the thoracic portion of the diverticulum caused cardiorespiratory disturbances. In the second case formation of hydrochloric acid and pepsin in the diverticulum produced ulceration in the neck of the diverticulum or nearby intestine, so that serious hemorrhage from the alimentary tract ensued. In the third case accumulation of acid material in the diverticulum produced an intense reaction in its wall and in regional structures with resulting chest pain.

Roentgen findings were not diagnostic, but there were

(9) Ann. Surg. 131 363 378 March 1950.

certain features by which this abnormality would probably be recognized or at least suspected if encountered again. In each case a shadow which appeared to be either a solid mass or a gas-containing viscus projected out from the mediastinum.

Surgical treatment of these abnormalities may lead to a long therapeutic course requiring several procedures, as in the first case, or it may be possible to remove the entire

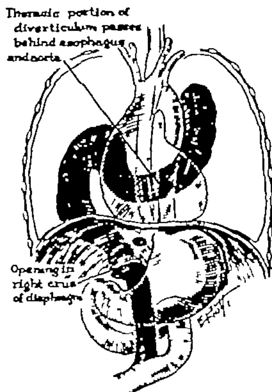


Fig. 31.—Long jejunal diverticulum extending up into chest of infant, aged 3½ months. (Courtesy of Gross, R. E., *et al.* Ann. Surg 131:363-375 March, 1950)

lesion at one sitting, as in the second. It will usually be impossible with any degree of safety to remove the infradiaphragmatic portion of the diverticulum through an anterior abdominal approach, but in some instances it can be removed through a right flank incision.

Thymectomy for Myasthenia Gravis Surgical Technic is discussed by O Theron Clagett, L. M. Eaton (Mayo Clinic) and Robert P Glover[1] (Mayo Found.), who have had ex

(1) Surgery 26:852-860 November 1949.

perience with 217 patients, 75 of whom were treated by thymectomy All patients with myasthenia gravis should be studied with posteroanterior lateral and oblique x rays to detect evidence of thymic tumors. Thymectomy should be advised in all instances of thymic tumor unless the patient's condition makes the risk of operation prohibitive It is also advisable for patients with moderately severe myasthenia gravis or progressive disease

METHOD—The patient should be hospitalized a few days before operation if possible, during which time neostigmine dosage is determined accurately Since myasthenic patients are very susceptible to respiratory infections, they should be fully protected from exposure. A course of penicillin may be indicated preoperatively Operation on females should be deferred until menstruation has ceased. If the patient is thin, weak and undernourished, every effort should be made to restore nutritional status. Oral neostigmine therapy should be continued up to the time of operation. Heavy preoperative sedation and barbiturates are to be avoided. Just before operation 1 1.5 mg neostigmine methylsulfate, ⅙-¼ gr morphine and ¹⁄₁₅₀ gr atropine should be administered subcutaneously Nitrous oxide, oxygen and ether administered through an intratracheal tube is the anesthetic of choice.

The most satisfactory approach for complete removal of the thymus gland in myasthenia gravis patients is the sternum-splitting incision (Fig 52) After the pretracheal fascia and soft tissues have been pushed away, a Lebsche sternal chisel is inserted and the manubrium and sternum split in the midline to the xiphoid process. A self retaining retractor is inserted and the split sternum spread apart, exposing the anterior mediastinum (Fig 53) The thymus is pinkish gray, has a fine granular surface and a very thin but definite capsule. Its blood supply is from the inferior thyroid and internal mammary arteries, and venous drainage is through one or occasionally two vessels which pass from the posterior wall of the isthmus of the gland into the left innominate vein. Since the gland is likely to be adherent to the pleura laterally, it is easy to open the pleura inadvertently during dissection. The gland extends posteriorly to the phrenic nerves and down over the pericardium. Since it is quite friable, it must be handled gently It may reach to the lower poles of the thyroid. After removal of the thymus closure is effected with interrupted catgut or silk sutures placed in the fascia and periosteum on the anterior surface of the sternum (Fig 54) Subcutaneous tissues and skin are closed with interrupted sutures. No drains are used. If the pleura has been opened, no attempt is made to close it, but all air is aspirated from the pleural space with a catheter and the anesthetist maintains expansion of the lung with positive pressure as the wound is closed. If weakness of respirations occurs during operation, 1 mg neostigmine methylsulfate should be

administered subcutaneously at once. The pharynx and tracheobronchial tree should be aspirated as necessary during operation and particularly at its completion. Postoperative bronchoscopy may be necessary to remove retained secretions.

Adequate exposure for removal of large thymic tumors may not be obtained through a sternum splitting incision. In such cases a posterolateral transpleural approach to the anterior mediastinum may be necessary

Postoperatively the patient should be placed in an oxygen tent for 12 24 hours. An aspiration device should be readily available until the patient has recovered from anesthesia. A Drinker type respirator should be kept in the patient's room and used if there is any evidence of weak or inadequate respiratory function despite neostigmine therapy Neostigmine methylsulfate in 1 mg doses should be given subcutaneously every two or three hours postoperatively but may be given more frequently or in larger amounts if necessary Oral administration of neostigmine bromide, in doses of 15 mg., may be resumed when the patient is able to swallow, then dosage should be adjusted to the requirements.

A sudden and dramatic relief of myasthenia gravis is not to be expected. Of the patients operated on, 31 had tumors of the thymus and 54 did not have tumors There were seven deaths, five in patients with tumors. It has not been possible to show statistically that patients with myasthenia gravis who have had thymectomy have benefited materially when compared with a group treated by medical means.

Tumors of Mediastinum Discussion of Diagnostic Procedure and Surgical Treatment Based on Experience with 44 Operated Cases is presented by Lyman A. Brewer, III, and Frank S Dolley[2] There were 35 benign and 9 malignant tumors

The symptoms may be classified according to the disturbance in function of the various organs in the mediastinum. Severity of symptoms depends on size and location of the tumor rapidity of growth and presence or absence of actual invasion of organs. One of the earliest and commonest symptoms is the feeling of a vague thoracic discomfort, fulness or ache. This is common in tumors that press on the chest wall, affecting the sensitive intercostal nerves. Respiratory symptoms are the next most important and are usually the direct result of pressure of the tumor mass on some portion of the respiratory tract. A dry cough is usually noted first, followed by expectoration of sputum. Gas-

(2) Am. Rev Tuberc. 60 419-438 October 1949

trointestinal symptoms result primarily from pressure on the esophagus The esophagus may be displaced considerably and only moderate obstruction result, provided there is no interference with esophageal peristalsis Obstruction of the great vessels in the mediastinum is common with malignant mediastinal tumors and is a poor prognostic sign.

Early in the course of mediastinal tumors there are a few demonstrable physical signs. X ray examination is the most important diagnostic aid. Posteroanterior, lateral and oblique films show the location on the anteroposterior plane Fluoroscopy and roentgen kymography are useful in distinguishing between the transmitted pulsation and the intrinsic expansile pulsation found in aneurysms of the great vessels. Bronchoscopy is an important diagnostic procedure when there is suspected tumor which presses on the trachea or major bronchi. Esophagoscopy is indicated only in posteriorly located tumors with which there is a possibility of esophageal involvement. In differential diagnosis of tumors near the aorta, exclusion of aortic aneurysm is most important. Serologic tests for syphilis are important procedures Tuberculin tests and examination for tubercle bacilli should be performed if tuberculosis is suspected. One of the most helpful diagnostic tests is the use of deep x ray therapy in possible cases of Hodgkin's disease or lymphoma lymphosarcoma. Prompt shrinkage usually means a tumor of this group If possible, biopsy should be carried out However, surgical exploration is often the only certain means of establishing diagnosis.

The usual locations of the commoner type of mediastinal lesions are shown in Figure 55 Conditions which simulate mediastinal tumors include carcinoma, benign tumors or cysts of the lungs, aneurysms, chest wall tumors, tuberculosis of mediastinal lymph nodes, hydatid disease, mediastinal abscess, superior vena cava thrombosis and diaphragmatic hernia. In this series neurogenic and teratoid tumors and cysts were the three most common benign lesions, whereas sarcoma and Hodgkin's disease were the most common malignant mediastinal tumors.

It is generally agreed that all benign mediastinal tumors should be removed by surgery Surgery is not indicated

for most malignant mediastinal tumors, but x ray treatment may be used Penicillin should be given before and after surgery The posterolateral approach to the mediastinum is preferred Splitting of the sternum is feasible sometimes when an anterosuperior mediastinal tumor presents directly beneath the sternum. Endotracheal anesthesia is necessary Great care must be taken to identify the ves-

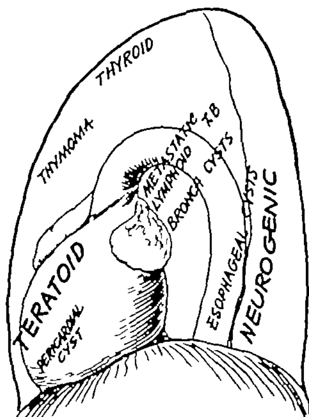


Fig 58 —Usual locations of common tumors of mediastinum. (Courtesy of Brewer L. A. III and Dolley F S. Am. Rev Tuberc. 60:419-436 October 1949)

sels supplying the tumor Temporary water seal, catheter drainage may be used 24-48 hours after surgery

There was no operative mortality in this series.

Mediastinal Tumors of Blood Vascular Origin. William D Seybold, John R. McDonald, O Theron Clagett and Stuart W Harrington[3] (Mayo Clinic) report 3 surgical cases of mediastinal tumor with the histologic picture of hemangioma or hemangioendothelioma, encountered among

(3) J Thoracic Surg 18 503-517 August, 1949

about 200 mediastinal tumors treated surgically at the Clinic before 1947 An incomplete review of the literature revealed reports of 14 additional cases in which evidence of blood vessel origin of the tumor seemed reasonably com plete

Primary mediastinal tumors are uncommon, those of blood vessel origin are rare The most frequent lesions are benign tumors of nerve origin and teratomatous or enterog enous cysts Many other varieties have been reported.

In two of the authors' three cases there was evidence of malignancy One lesion had invaded surrounding medi astinal structures and was too extensive for surgical re moval, the other was histologically of low grade malignancy and had invaded a contiguous sympathetic ganglion. The third patient had a benign hemangioma. Of the 14 cases from the literature there was evidence of malignancy in 8 in 6 of these the lesions were histologically malignant and in 2 they were called histologically benign, but there were regional and distant metastases.

The lesion was removed from 6 of the entire group of 17 patients, and 4 were living at the time of the last reports. This fact cannot be interpreted in terms of operability for some patients came under observation long before lesions in the mediastinum were surgically accessible

Evidence suggests that so-called benign hemangiomas as sociated with metastatic tumors are in reality multiple pri mary lesions The outlook for a patient with a single well encapsulated histologically benign hemangioma of the mediastinum is probably excellent. Even when it is not well encapsulated and cannot be completely removed, the out come is hopeful since Adams and Bloch's patient was well four years after operation. Prognosis must be guarded for a lesion with histologic features of malignancy, and prog nosis in the individual case cannot be predicted on the basis of histologic appearance alone

No mediastinal tumor produces a sufficiently distinctive clinical or roentgen picture to permit a consistently accu rate pathologic diagnosis. Many of these tumors are malig nant, others have malignant potentialities. All should be removed surgically unless there is a definite contraindica tion.

Survey of the eight known cases suggests that it would be difficult to make a more accurate preoperative diagnosis of mediastinal granuloma. Roentgenograms certainly have not demonstrated typical masses. Exploration will be necessary in nearly all cases. Since five of the eight patients

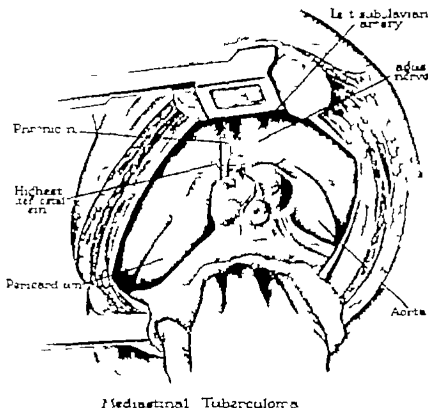


Fig. 56.—Drawing at operation, showing lobulated and cystic mass in left hilar region. (Courtesy of Samson, P. C., et al.: J. Thoracic Surg. 19:332-346, March, 1950.)

had definite symptoms referable to the mass, granulomas should be removed if exploration is done. The lesions found were unquestionably chronic granulomas. Whether the infection is due to the tubercle bacillus is uncertain.

[It is doubtful that these lesions should be called tuberculomas. The authors acknowledge that doubt by placing quotation marks around the word. The advisability of deliberately removing tuberculous lymph nodes from the mediastinum is yet to be demonstrated.—Ed.]

Cardiac Resuscitation in six cases of cardiac arrest is reported by Julian Johnson and Charles K. Kirby[6] (Univ of Pennsylvania) The success of cardiac massage depends on restoration of oxygenated blood to the brain in three to four minutes It is seldom successful except in emergencies in the operating room but even then it is unlikely if the patient has severe myocardial injury If an emergency should arise outside the operating room, the following treatment should be given.

TREATMENT.—Until oxygenation can be maintained by the bag and-mask technic or by the Kreiselman bellows resuscitator, the patient's lungs are ventilated by the mouth to-mouth technic. If pulse and blood pressure suddenly cannot be obtained, the chest is opened immediately. The surgeon should have his hand on the heart in 10-15 seconds. Incision is made in the left fourth interspace from about the edge of the sternum to the posterior axillary line. Since there is no bleeding the incision can be extended quickly through the chest wall and pleura. One hand can then readily be placed between the fourth and fifth ribs to feel the heart. If arrested, the heart will be still but if it is in ventricular fibrillation it will feel like a "bag of worms." If a rib spreader is not immediately available, the fourth and fifth cartilages are divided with a knife or scissors held in the left hand while the heart is compressed as rapidly as possible with the right hand.

In ventricular fibrillation countershock therapy must almost always be used with defibrillation. Epinephrine is seldom used because it tends to produce ventricular fibrillation. Procaine is used routinely to prevent or stop ventricular fibrillation. Before defibrillation, anoxia is overcome by cardiac massage and artificial ventilation with 100 per cent oxygen. The right ventricle is injected with 3 cc. of 2 per cent procaine, an equal amount is injected into the pericardial cavity unless procaine has previously been given intravenously. Electrodes are then placed on each side of the ventricles and an alternating current (60 c.) of 1 1½ amp is passed through the heart for less than a second. Repetition of shock may be necessary

In each of six cases, cardiac resuscitation was accomplished. Two cases follow

CASE 1.—Boy, 9 had left lower lobectomy for bronchiectasis in the face down position. The left lobe had been removed and the pleural flap was being elevated from over the vagus nerve when cardiac arrest and absence of pulse were noted simultaneously After

(6) S. Clin. North America 29 1745-1753 December 1949

less than 1 minute of cardiac asystole, cardiac massage was started and the beat resumed in 30 seconds. Postoperative recovery was uneventful. Since anoxia was not apparent, a vagovagal reflex may have been the mechanism.

CASE 5.—Woman, 74, with a history of angina pectoris, was heard to sigh while awaiting cystoscopy. There were no signs of life. Positive pressure ventilation was started. Cardiac massage was begun after four to five minutes of asystole. Her color improved in one minute, and ventricular fibrillation was felt in two minutes. Procaine was injected and countershocks with the defibrillator were given with good results. Respiration resumed in 20 minutes. She regained consciousness but died 40 hours after operation. At autopsy, extensive myocardial fibrosis was found.

[This is a very important subject. Already in most thoracic surgical clinics lives have been saved by prompt resuscitation of the heart. When the methods now in use are more generally employed, and particularly when it is more commonly recognized that prompt and active measures for resuscitation will often give satisfactory results many more unnecessary deaths will be avoided.—Ed.]

Penetrating Stab Wound of Heart. Robert S. Wilkinson and Myra A. Logan[7] report seven cases of penetrating stab wounds of the heart, with survival in five, and describe *the routine management of such injuries at Harlem Hospital.* Clinically, there may be a brief symptom free period during which the patient may walk a short distance, followed by rapid collapse. Cardiac tamponade is evident from weak heart sounds associated with weak pulse, lowered arterial pressure and elevated venous pressure. Precordial dulness may be moderately increased and the large neck veins engorged. Respiration is rapid and shallow. Progressive tension pneumothorax or progressive hemothorax may also be present.

METHOD.—Even though the patient appears to be moribund, rapid exploration should be done. Delay for preoperative x rays and electrocardiograms is not warranted. Plasma is administered on admission, *a slow blood transfusion is begun as soon as blood is typed.*

The transpleural approach should be used because it is faster and permits inspection of the pleural cavity for hemorrhage or massive pneumothorax. One or more ribs and costal cartilages overlying the heart are removed. If open anesthesia is used, the lung is grasped with sponge forceps to stabilize the mediastinum, but use of endotracheal anesthesia makes this step unnecessary. The pericardium is widely opened. Many patients who are pulseless and without measurable blood pressure on admission show rapid improvement when this is done. If the wound in the myocardium presents, it is sutured at once. If it is not seen, fluid blood and clots are evacuated and

(7) Harlem Hosp. Bull. 2: 91-100, December, 1949.

the heart is inspected. In this series most of the wounds were ventricular Interrupted sutures of fine silk or fine catgut are placed near the edge of the wound to avoid branches of the coronary vessels during closure. The wound edges are approximated to prevent too much tension Since the penetrating instrument may have gone through both the anterior and posterior walls, the posterior walls should be inspected after the anterior wall is sutured. The pericardial cavity is left open so that blood or serum will drain into the pleural cavity rather than produce another tamponade and so that drainage is available in case pericarditis develops. The left lung is sutured to the edges of the chest wall defect and the wound closed with a Penrose tube drain placed down to the fascia. If open anesthesia is used, a needle is inserted into the second left interspace anteriorly for underwater drainage of a potential pneumothorax.

Early postoperative administration of adequate blood and oxygen are of vital importance. This regimen is supplemented by parenteral administration of electrolytes, proteins and vitamins. Penicillin or aureomycin may be used to prevent some of the major postoperative complications. The patient should be observed closely for complications such as tension pneumothorax, pleural or pericardial effusions, other pulmonary complications or infarction due to coronary occlusion. Serial electrocardiograms, pneumothorax readings, serial x rays and careful clinical examination are helpful for this purpose. The necessary period of bed rest postoperatively varies with the severity of myocardial damage and complications.

Surgical Treatment of Complete Transposition of Aorta and Pulmonary Artery is described by Alfred Blalock and C Rollins Hanlon[8] (Johns Hopkins Univ) In 33 patients it consisted of construction of extracardiac venous or arterial shunts creation of an auricular septal defect or creation of an auricular septal defect plus an extracardiac arterial shunt. Twenty two of the first 28 patients operated on died, but 8 of 12 treated by the combined procedure are living and have various degrees of improvement Most of the deaths were attributable to the precarious condition of the patient use of procedures now considered unsound or technical errors

To perform the combined procedure an intra auricular defect is created by excision of the auricular septum. The shunt is made by anastomosing the proximal end of the divided subclavian artery to the distal end of the pulmonary artery to the right upper lobe (Fig 57) A diagram of the circulation after completion of the operation is shown in Figures 58 and 59 A large part of the additional blood sent

(8) Surg., Gynec & Obst. 90 1 15 January 1950

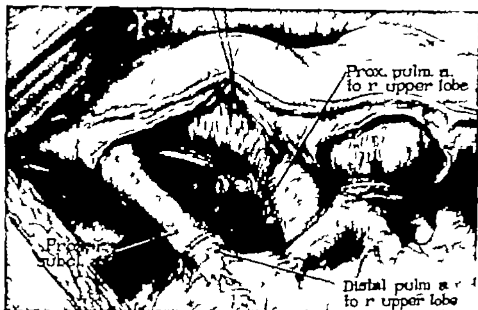


Fig. 57.—Proximal pulmonary artery to right upper lobe has been sutured after di ision. Proximal end of right subclavian artery has been sutured to distal end of pulmonary artery to right upper lobe. (Courtesy of Blalock, A. and Hanlon C. R.: Surg., Gynec. & Obst. 90 1 15 January 1950.)

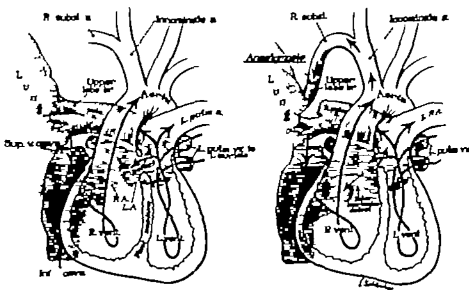


Fig. 58 (left).—Transposition of great vessels before surgery. Diagram shows cross circulation through interventricular defect but auricular septum is intact.

Fig. 59 (right).—Conditions after formation of interauricular defect and extracardiac shunt from right subclavian artery to right upper lobe. Interauricular defect permits two way flow between auricles.

(Courtesy of Blalock, A. and Hanlon, C. R. Surg. Gynec. & Obst. 90 1 15 January 1950.)

to the right lung through the subclavian artery returns to the right auricle because of the septal defect This avoids the danger usually associated with a unidirectional shunt in transposition, since the septal defect acts to equalize pressure on the two sides of the circulation.

Surgery of Pulmonary Stenosis Experiences with Left Subclavian to Left Pulmonary Artery Anastomosis are reported by Emile Holman[9] (Stanford Univ) Of 38 patients with cyanosis who were operated on, all but 1 were thought to have tetralogy of Fallot This one patient was much improved by surgery and was thought to have a tricuspid stenosis with an open foramen ovale

Thoracotomy without anastomosis was performed on seven patients, with five deaths The fatalities resulted from increased deflection of unaerated blood into the systemic circulation through an interventricular septal defect, due to increased peripheral resistance in the pulmonary vascular bed incident to anesthesia and to surgery In a boy aged 6 neither pulmonary artery could be found in either of two exploratory operations but he was still living at the time of the report

In 29 patients a systemic artery was joined to the pulmonary artery as proposed by Blalock in 3 the right subclavian artery was joined to the right pulmonary artery with 1 death (patient, aged 19 months) and with excellent results in 2, in 2, the innominate artery was joined to the pulmonary artery with excellent results in 1, uniting the right common carotid and right pulmonary arteries was followed by a temporary left hemiplegia In the 23 other patients, the left rather than right subclavian artery was joined to the left pulmonary artery because of its greater length. Good to excellent results were obtained in 21 and 2 died. Blalock's objection to this procedure is that in bringing the left subclavian artery over the arch of the aorta, the acuteness of the angle at the origin of the artery interferes with the flow of blood through it. However such interference is obvious immediately on releasing the clamps and opening the anastomosis and may be corrected by complete division of the pulmonary artery proximal to the end-to-side anastomosis. Such complete division was found nec

(9) J Thoracic Surg. 18 827-838 December 1949

essary in only 4 of the 23 cases In one patient who died, the ligature on the distal end of the divided subclavian artery was anchored to the thoracic wall under tension, resulting in a fatal hemorrhage. This emphasizes the im portance of ligating the distal artery doubly or ligating and transfixing it without tension.

In two patients, aged 9 months, Pott's procedure of direct anastomosis between pulmonary artery and arch of aorta was performed with one excellent result and one death.

Although Blalock has stated that operation should not be done when the pulmonary arterial pressure exceeds 300 mm. water, excellent results were obtained in a child, aged 4, in whom pressure was 370 mm. water

Blalock's anterior incision through the third interspace was replaced in girls by a left anterolateral approach through the third interspace to avoid conspicuously visible anterior scars and possible injury to breast tissue In boys an anterior approach through the second interspace was used, with division of the second and third costal cartilages. In performing anastomosis, a longitudinal rather than a transverse incision was made in the pulmonary artery, the suture used was a continuous intima to-intima approxima *tion in the anterior half of the circular anastomosis.* An effort was made to interrupt completely the circular silk suture at two points, thus avoiding a complete circular suture of nonabsorbable silk which might result in a non distensible opening

It must be recognized that establishment of an artificial patent ductus may cause cardiac failure, bacterial endocarditis or endarteritis, and that life expectancy is no *greater than that in a patient with a patent ductus.* How ever, the greatly improved physical status of these patients is a great boon to distraught parents

[The possibility of a late complication of endocarditis is probably not so much to be feared as it would be if we did not have the new antibiotic drugs.—Ed.]

Ligation of Left Auricular Appendage for Recurrent Embolization was carried out by Ivan D Baronofsky (Univ of Minnesota) and Abbott Skinner[1] (Ancker Hosp., St. Paul)

(1) Surgery 27 848-852 June, 1950

in three patients with rheumatic mitral stenosis More experience is needed before indications and contraindications for ligation of an auricular appendage can be listed. Absence of auricular fibrillation is not a contraindication, because embolization can occur in a purely mitral rheumatic heart without this disorder In none of the patients in the present series has fibrillation stopped as a result of ligation of the appendage

In one case a horseshoe type of suture was first placed around the base of the auricular appendage and a secondary tie of umbilical tape was then placed in the same position. In the other two cases only a tie of umbilical tape was placed. No effort was made to remove a thrombus if present. In the future it might be better to place a tie of umbilical tape around the base of the auricle, open the tip, remove any thrombus present and then place a second tie to close the opening

In all cases evidence of additional emboli was not detected after ligation of the appendage Postoperative recovery was *essentially uneventful*

Technic for Division and Suture of Patent Ductus Arteriosus in Older Age Group, with control of the components of the shunt by pericardiotomy with digital pressure on the left pulmonary artery and a Potts-Smith clamp on the aorta, was first tried in four dogs by Norman E Freeman, Frank H. Leeds and Richard E Gardner[2] (Univ of California), who then used it successfully in a patient.

TECHNIC.—Through a left fourth interspace incision, the chest was opened and the mediastinal pleura incised posterior to the vagus nerve. The vagus and recurrent laryngeal nerves were freed and a rubber band was placed around them for retraction. The aorta was mobilized close to the origin of the left subclavian artery and surrounded by a rubber tube, the aorta below the ligamentum arteriosum was also surrounded by a rubber tube. The space between aorta and pulmonary artery was opened by blunt dissection with a curved hemostat. The pericardium was opened posterior to the phrenic nerve. The ligamentum arteriosum was freed by following the line of cleavage of the recurrent laryngeal nerve. A suture was passed about the ligamentum and included portions of the pulmonary artery wall. Good control of blood flow in the pulmonary end of the ductus arteriosus was obtained by digital pressure on the left pulmonary artery through the pericardiotomy With use of the pre-

(2) Surgery 26:103 108, July 1949

viously placed rubber tubes for traction, a Potts-Smith clamp was placed around the aorta so as to isolate the aortic origin of the ductus when the clamp was closed (Fig 60) The ligature on the pulmonary end of the ligamentum arteriosum was tied, the ligamentum divided and its aortic part with a small portion of the aortic wall excised. The aorta was rotated outward and the opening in it closed with a longitudinal running stitch. The clamp was released and the pericardiotomy incision partially closed with two interrupted cotton sutures. The chest was then closed in layers.

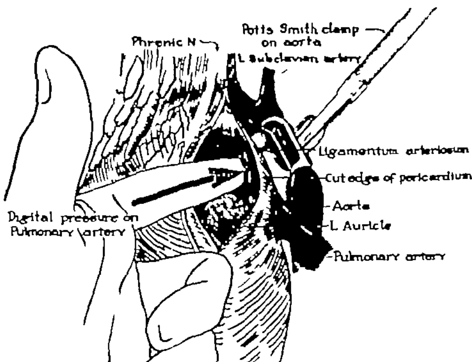


Fig. 60 —Technic for excision of ligamentum arteriosum in dog with use of Potts-Smith clamp. (Courtesy of Freeman, N E., *et al* Surgery 26:103 108 July 1949)

Because of the straight handle it was sometimes difficult to place the clamp without excessive traction on the aorta and although clamps of various sizes were available, there was usually a discrepancy between the diameter of the aorta and that of the clamp Best results were obtained with a clamp slightly smaller than the vessel but then there was a tendency for the aortic wall to bulge forward excessively and for the back of the clamp to pinch the wall. Therefore, a clamp was designed which has a swivel handle guides on the lower jaw to prevent bulging of the aorta

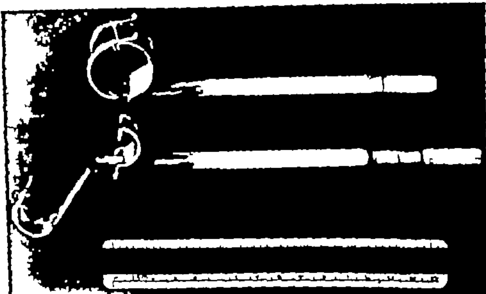


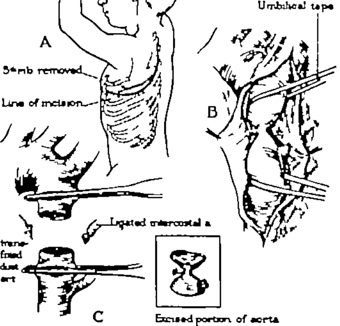
Fig 61.—Modification of Potts-Smith clamp for occlusion of origin of patent ductus arteriosus. (Courtesy of Freeman N. E., et al. Surgery 26 103 108 July 1949.)

and a smooth back that cannot traumatize the vessel (Fig 61) Some authors have reported cases of direct arteriovenous fistula between aorta and pulmonary artery, the technic described lends itself admirably to surgical repair of this type of defect

Technic of Resection of Coarctation of Aorta with Aid of New Instruments To lessen the possibility of sudden uncontrollable hemorrhage during operation, Willis J Potts[3] (Chicago) has devised new coarctation clamps and a vise to hold them.

TECHNIC.—A long curved posterolateral incision (Fig 62*A*) is made beneath the left scapula and the chest entered through the base of the resected fifth rib. The parietal pleura over the constricted portion of the aorta is cut longitudinally and the aorta freed sufficiently above and below the constriction. Strips of umbilical tape are passed beneath the aorta to serve as tractors to elevate it and as safeguards for control of unexpected sudden hemorrhage (Fig 62*B*) The ductus arteriosus or the ligamentum arteriosum is dissected from its bed, ligated and cut. Only those intercostal arteries, usually one or two which arise at or near the coarctation and will be in the way during suture are doubly ligated and cut. The clamps are applied (Fig 62*C*) above and below the segment to be resected and the segment is cut out with sharp scissors at such levels that the open ends are of the same diameter All blood is lavaged

(3) Am. Surg. 131 466-47 April, 1950



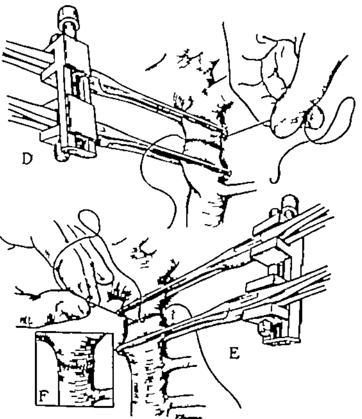


Fig. 62.—*A* skin incision ½ in. below tip of scapula; *B* umbilical tapes above and below coarctation; *C* ductus arteriosus attached to coarcted portion of aorta; *D*, suture begun at upper angle, with clamps turned up and away from operator; *E* clamps in original position; *F* suture completed. (Courtesy of Potts, W J: Ann. Surg. 131:466-472, April 1950.)

away with a stream of physiologic saline solution. The vise is applied (Fig 62D) with clamps snugly fixed. On turning the knurled nut the segments of the aorta are drawn together to exactly the coaptation desired. The clamps, held in one hand by the assistant, are turned forward and suture is begun at the angle closest to the operator No 00000 Deknatel silk is used. The over and-over stitch is carried to the inferior angle, the clamps are turned backward and the suture is completed (Fig 62E) and tied to the free end at the starting point. The distal clamp is released first, if there is no bleeding, it is removed and the proximal clamp is likewise released and removed. The parietal pleura is closed over the aorta. A mushroom catheter with all but the flange removed is drawn through the sixth or seventh interspace from the inside out, this drainage catheter is later connected with a tube in an underwater seal bottle. The lung is re-expanded and the chest closed in layers with fine running catgut sutures. Crystalline penicillin, 100,000 units, is given twice daily for a week. The patient is kept in the hospital for two weeks. Arm and leg blood pressures are measured every other day

Five patients aged 7 16, at Children's Memorial Hospital, have been operated on by this method without complications or mortality In each patient the femoral pulse has been vigorous immediately after operation and has remained so

Clinical Experiences with Application of Polythene Cellophane on Aneurysms of Thoracic Vessels are reported by Osler A. Abbott[4] (Emory Univ) The method relies on formation of a chronic, progressive, constrictive, periarterial, fibroblastic reaction that will ultimately obliterate the aneurysmal cavity or at least strengthen the wall sufficiently to eliminate the threat of fatal rupture The cellophane—1.5 mil Polythene (NV 7 14)—is sterilized by keeping it in 70 per cent alcohol for 24-48 hours before use (Further experience has shown that the Polythene cellophane should be prepared by steam sterilization for 20 minutes Alcohol may discolor the initiating substance dicetyl phosphate) After exposure of the aneurysmal area of the vessel, plus at least 2 in. of vessel above and below, the material is applied in two to four thicknesses so as to surround the diseased area and 1 2 in. of apparently normal vessel above and below the aneurysm The material is laid in contact with the aneurysm without constricting it and is kept in place by suturing to near by structures and to sufficiently healthy vascular wall. Fine arterial silk is used to sew the

(4) J Thoracic Surg 18:435-461 August, 1949

material directly to the vessel wall. Chemotherapeutic agents are used liberally before, during and after operation.

Abbott has used this method on 32 patients, with addition of internal wiring in 4. Most lesions were syphilitic in origin. Two patients had presumably congenital aneurysms. In one, the lesion was a diffuse aneurysmal dilatation of the pulmonary artery, probably secondary to a massive interatrial septal defect. In the other, an unusual congenital anomaly of the descending portion of the thoracic aorta could not be completely surrounded, so definite benefit was not obtained. A woman, 31, had an aneurysm of the main pulmonary artery associated with diffuse sclerosis of the pulmonary and systemic arteries and died postoperatively. Autopsy suggested that irritative cellophane should not come in contact with irritable areas of the cardiac wall and that an inner layer of nonirritative cellophane should be used when the substance is placed in the pericardium.

Abbott has used two main methods of enlargement of the thoracic inlet. When the primary disease is far enough from the upper part of the sternum, a one stage split of the sternum with supportive splints to maintain the spreading is recommended. However, in most cases Abbott found it necessary to remove a portion of the clavicle and first two ribs, with particular attention to transection of the ligaments behind the clavicle to allow anterior elevation of the sternum. It was usually necessary to carry out this procedure bilaterally, and it should not be done under general anesthesia. Two to four weeks is usually required for adequate pulmonary reaeration to occur and edema of the airway to disappear

Sufficient benefit was derived by patients with far advanced cases to justify continued use of the method.

Surgical Relief of Congestion in Pulmonary Circulation in Cases of Severe Mitral Stenosis Preliminary Report of Six Cases Treated by Anastomosis between Pulmonary and Systemic Venous Systems Richard H. Sweet and Edward F Bland[5] (Massachusetts Gen'l Hosp) point out that about 10 per cent of persons with rheumatic disease of the mitral valve ultimately develop marked stenosis, and, although some may not have striking symptoms, others have attacks

(5) Am. Surg 130 384-397 September 1949

of pulmonary edema precipitated by menstruation, pregnancy, intercurrent infections, fever or tachycardia induced by emotional disturbances or unaccustomed physical exertion. The phenomenon depends on the concurrence of long standing mitral stenosis with continuous increase in pressure in the pulmonary circulation and right ventricle hypertrophy Under stress the strong right ventricle forces the blood into the lung so as to increase greatly the already elevated pressure in the pulmonary vessels, and inevitably there is transudation of fluid and often of blood into the pulmonary alveoli, producing the clinical picture of pul

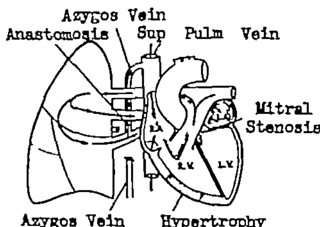


Fig. 62 —Pulmonary-azygos venous shunt. Mechanical effect of shunt between pulmonary and systemic venous circulations produced by anastomosis between azygos vein and right inferior pulmonic vein. Arrows show that some blood in inferior pulmonary vein is forced by high pressure in pulmonary circuit to enter azygos vein through shunt, thus relieving to some extent excess pulmonary pressure. (Courtesy of Sweet, R. H., and Bland, E. F : Ann. Surg. 130 384 397 September 1949)

monary edema When the attacks occur frequently the patient lives in jeopardy and is forced to limit activity even though the heart muscle remains competent. Such patients often die of pulmonary failure rather than of failure of the heart itself For such patients a release of pressure in the left auricle such as might result from anastomosis between the cardiac end of the pulmonary vein and the cardiac end of the severed azygos vein, might produce a desirable effect on the lung congestion (Fig 63)

Technic.—To avoid an attack of pulmonary congestion as the result of excitement the patient is put to sleep in his room with pentothal* injected intravenously and then moved to the operating room. Administration of ether mixed with oxygen is begun through an intratracheal tube while he is still asleep The surgeon should work

an attack of pulmonary edema since leaving the hospital, all had been semi invalids preoperatively and two were un able to carry on outside the hospital All are now leading normal lives after a long period of disability preoperatively Exertional dyspnea and palpitation have diminished. It has been demonstrated on the operating table that the shunt significantly lowers pressure in the left auricle, but how great a reduction in intra auricular pressure can be induced without impairment of peripheral circulation is not known, although present experience has not suggested that any unfavorable result has been produced In one patient cath eter studies demonstrated a continuation of the decrease in pressure in the pulmonary circuit after establishment of the anastomosis

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HYPERTENSION

Sympathectomy in Hypertension. The results of Smith wick's, Adson's or Boyd's operations in 80 patients are evaluated by Robert Platt and S W Stanbury[6] (Univ of Manchester) Many patients were followed two to three years. Preoperatively the patients usually had diastolic pressures of 120 mm. or more while in bed, were free from serious cardiac insufficiency and had reasonably good renal function. Papilledema (malignant hypertension) was present in 24 patients and essential hypertension in 51, in 16 there appeared to be a primary renal cause There were 23 deaths, but 5 were accidental.

A significant reduction in blood pressure was achieved in only 11 of the 80 patients. In at least 12 with malignant hypertension papilledema disappeared without an appreciable change in blood pressure in 10 others, retinal hemor rhages or exudate rapidly disappeared postoperatively but 7 showed no change in blood pressure Nearly all survivors who had had severe headaches obtained relief. Some pa tients with malignant hypertension died from operation. Others exchanged severe headaches for severe exertional tachycardia and fatigability

(6) Lancet 1 651-659 Apr. 8 1950

Before performing sympathectomy, physicians must realize that there is no evidence that a symptom free patient with essential hypertension and a diastolic pressure of 115 mm. Hg or less would be better prognostically if the pressure were reduced to 80-90 mm. by surgery There is little chance of altering blood pressure by surgery. There is little of either sex over age 45, regardless of the type of hypertension. There is little evidence that sympathectomy benefits those over 45, especially men, those who have had more than one cerebral thrombosis, or those with congestive cardiac or renal failure large vessel sclerosis, angina pectoris or myocardial infarction. Essential hypertension patients in the late thirties or early forties with exertional dyspnea and enlarged hearts should be managed by restricted activity, sedation, weight reduction and reduced salt intake Sympathectomy should be considered only when conservative treatment is unsuccessful or impracticable Sympathectomy may be helpful in severe hypertension in young adults when they have the essential type or when it is secondary to a renal lesion such as pyelonephritis or type 1 nephritis. If the nephropathy is active and progressive, sympathectomy is of no value If the renal lesion is inactive, function is good and diastolic pressure is 125-150 mm. Hg operation should be performed whether or not hypertension is malignant. If the young adult has essential hypertension, much thought and care is necessary in arriving at the decision to operate and postponing it for a year or two is justifiable If diastolic pressure remains at 125-140 mm. Hg, severe headache develops or a cerebral episode occurs operation is justifiable Children should not have sympathectomy because of high blood pressure alone The operation may be used in selected cases in an attempt to preserve vision. It is justifiable as a symptomatic measure for relief of crippling headache but relief may be bought at the price of new symptoms

Symptomatic relief was about the same regardless of the operative procedure used in this series Boyd's extensive operation tended to produce more symptoms of exertional dyspnea and tachycardia In general, sympathectomy has a limited role in treatment of hypertensive disease

Corticoadrenal Factor in Hypertension. Geza de Takats[7] (Univ of Illinois) determined insulin tolerance curves on 50 consecutive hypertensive patients during their preoperative study 31 showed a normal response, 4 a delayed response, 7 an early dip with faster return to normal than usual, and 8 no response To determine whether insulin resistance of these eight patients was really due to increased pituitary corticoadrenal activity, intravenous sugar tolerance (Soskin) and water tolerance tests were performed. Sugar tolerance seems to be diminished in corticoadrenal stress, just as in acromegaly Water tolerance, dependent on a number of factors, is a sensitive index of renal function and has prognostic value as to the expected results from splanchnic section Trials were made with the Soffer salt tolerance test, Thorn's uric acid-creatinine ratio and Selye's sodium chloride ratio, but they were not simple enough or the significance of results could not be evaluated

Result of the simple clinical tests of insulin, sugar and water tolerance seemed to indicate corticoadrenal hyperactivity in 16 per cent of the 50 patients. Splanchnic nerve section diminishes this hyperactivity gradually over three to six months if it is due to simple hyperfunction.

From a practical standpoint, insulin resistance is suggestive of corticoadrenal hyperfunction. In hypertension of this type corticoadrenal adenoma or simple hypertrophy may be found. Whether splanchnic nerve section alone will bring about a slow involution or bilateral partial resection of the adrenal gland should be done is yet to be determined.

There has been no correlation as yet between insulin resistance and response to sodium restriction. If it could be shown that sodium restriction acts through dampening the corticoadrenal factor as suggested by Grollmann and associates, insulin tolerance determination might provide a simple way of selecting patients for low salt diet. Hypertensive patients who have not responded to splanchnic nerve section and yet do not show extensive adrenal damage may well be benefited by salt restriction

The water tolerance test has value in predicting results of splanchnic nerve section. Although the corticoadrenal factor the posterior pituitary factor and the renal factor

(7) Surgery 26 67 81 July 1949

are all involved certain water tolerance curves are so suggestive of late nephrosclerosis that with the results of other renal function tests they contraindicate operation.

Förster's Hypertension Chordotomy Chr van Gelderen[8] (Amsterdam) points out that in chordotomy for essential hypertension it is necessary to avoid the lateral pyramidal tract posteriorly and Edinger's nucleus anteriorly, consequently, the knife is inserted only at the dentate ligament and is not allowed to cut toward the anterior root when pulled out (Fig 65) The knife must be inserted perpendicularly and penetrate about 3-4 mm., a von Graefe cataract knife or a "two-

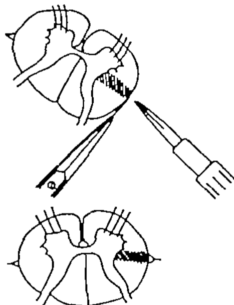


Fig 65 —Chordotomy for hypertension. (Courtesy of van Gelderen, C. Chirurg 20 358-361 July 1949)

edged chordotome cuts hardly more than the supranuclear diencephalospinal vasoconstrictor tract of the caudal half of the body If cutting of the arm fibers is considered as well, so far as they are present at the level of operation, a curved chordotome may also be used, it must be inserted somewhat backward and deeper Since motor loss is more undesirable than loss of thermal sensation, the principal rule is to spare the lateral pyramidal tract. Van Gelderen reports the following case

Woman, 37, had malignant hypertension with cardiac hypertrophy albuminuric retinitis, blood pressure ranging between 260/170 and 210/140 and urea clearance of 60 per cent. Under local anesthesia, through a small laminectomy in the region of the second and third dorsal vertebrae the dura was opened and the cord rotated by pulling on the dentate ligament on the right side. The knife was inserted, at the site of attachment of the ligament to the pia mater, perpendicularly to a depth of 3 mm. and pulled out in the same direction. The procedure was repeated on the left side. Blood

(8) Chirurg 20 358-361 July 1949

pressure was then 130/80 The wound was closed. For the sake of safety, chordotomy was not done at the same level on the two sides, because a difference of a few centimeters helps limit temporary effects of postoperative edema. Slight thermohypesthesia, that disappeared the following day, involved the right side of the body and thus corresponded to the second, or left, insertion of the knife. Blood pressure remained between 150/90 and 180/110 and urea clearance at 55 per cent. Even so, the result was good subjectively and objectively

Van Gelderen concludes that a correctly performed and successful chordotomy for hypertension causes no or only insignificant somatoneurologic undesirable phenomena.

Technic for Extensive Thoracolumbar Sympathectomy without Rib Resection. The procedure described by Theodore B Massell, Jerome Ettinger and Jack R Voskamp[9] (Los Angeles) provides better exposure permits more extensive

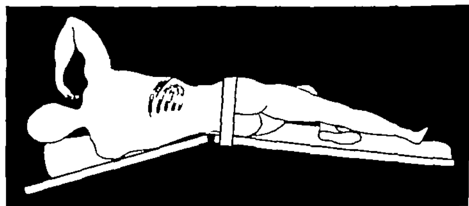


Fig 66.—Position of patient on operating table. Incision, shown in eighth interspace is used when especially high level of sympathectomy is desired but is usually less satisfactory for lumbar part of operation than approach through ninth interspace. (Courtesy of Massell T B. *et al* Surgery 27 82 92 January 1950)

removal of the thoracic sympathetic chain permits vagotomy and has a lower incidence of postoperative complications than the commonly used retropleural approach with rib resection. It proved satisfactory in 26 consecutive cases in which sympathectomy was performed for hypertension

METHOD.—The patient is placed on the operating table in the position shown in Figure 66 An incision is made in the ninth interspace extending forward about 20 cm. from the costal angle. When the intercostal incision is completed the ribs are separated gradually by a Finochietto retractor The great splanchnic nerve and the

(9) Surgery 27 82 92 January 1950



Fig 67 (top) —Incision of vertebral pleura after opening of chest and separation of ribs.
Fig. 68 (bottom) —Severing of communicating branches of first lumbar ganglion. (Courtesy of Maxwell, T B et al Surgery 27 8 92 January 1950)

sympathetic chain covered by the parietal pleura are identified on the lower thoracic vertebrae The pleura is incised longitudinally midway between the sympathetic and great splanchnic nerve trunks

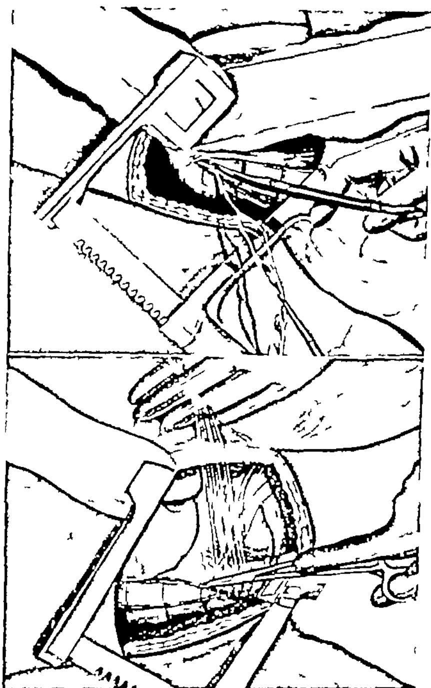


Fig. 69 (top).—Mobilization of upper thoracic sympathetic ganglions.
Fig. 70 (bottom).—Closing of vertebral pleura incision after reconstruction of diaphragm.
(Courtesy of Maxwell, T. B. *et al.* Surgery 27:82-92, January 1950.)

(Fig 67) The pleural incision is carried down to the diaphragm, which is incised for 10 cm. parallel to and 3 cm. from the costal attachment. The kidney is retracted forward, exposing the psoas muscle, which is cleared of loose areolar tissue. The large first lumbar ganglion is easily identified and mobilized by cutting communicating rami (Fig 68) Dissection is carried caudalward until the second lumbar sympathetic ganglion has been mobilized. A silver dura clip is placed on the chain distal to the second ganglion as an x ray marker and the nerve severed just proximal to the clip Dissection of the sympathetic chain is carried cephalad, mobilizing the roots of the various splanchnic nerves as they are reached. When the sympathetic trunk has been freed to the level of the origin of the uppermost splanchnic root, dissection of the splanchnic nerves is completed and they are severed at the upper marginal level of the semilunar ganglion Cutting of the splanchnic nerves is thus deferred until sympathectomy is almost complete, because of the sudden drop of blood pressure which usually follows splanchnic section. This sudden marked hypotension may be partially overcome by removing the break in the operating table and placing the patient in moderate Trendelenburg position. Mobilization of the upper thoracic sympathetic ganglions is then completed (Fig. 69) The upper level of sympathectomy varies from the fifth to the second thoracic ganglion, depending on the preoperative condition and response to operation. If there is evidence of coronary artery disease or angina pectoris, sympathectomy may be extended especially on the left to include the third and second thoracic ganglions. The uppermost extent of sympathectomy is marked with a dura clip before the chain is severed.

The diaphragm is reconstructed with interrupted no. 40 cotton sutures. The lowermost fourth of the incision of the vertebral pleura is closed with the same material, but the remaining longitudinal opening in the pleura is not sutured (Fig 70) The thoracotomy incision is closed in layers with no. 20 cotton for the parietal pleura and intercostal muscles, continuous fine chrome catgut for the other muscle layers and cotton or silk for the skin. During closure a large rubber catheter is placed in the pleural cavity to provide a vent for escape of air as the lung is re-expanded under positive pressure. The catheter is removed after closure is completed.

PERIPHERAL ARTERIAL SYSTEM

Diagnosis and Treatment of Vascular Diseases, with Special Consideration of Clinical Plethysmography and Surgical Physiology of Autonomic Nervous System. R. H. Goetz[1] (Univ of Capetown) describes the application of a simple

(1) Brit. J Surg 3 74-40 July 1949

portable digital plethysmograph with which blood flow through the skin and peripheral circulation may be studied

METHOD.—Peripheral blood flow changes are recorded by enclosing a finger or toe in a glass container which is connected to a specially constructed pipet (0 01 cc. graduation) containing a column of alcohol. The plethysmograph is sealed with soft petroleum jelly but should not be so tight as to interfere with circulation. Any change in the volume of the digit is transmitted to the alcohol column of the pipet, the meniscus of which is enlarged and projected (Fig 71) on the photographic paper of a recording camera. A tap permits adjustment of the alcohol column so that changes in volume are not accompanied by changes in pressure within the system.

This method is sensitive enough to register the volume changes occurring with each heart beat (pulse volume) as well as the changes in the volume of the digit as a whole (digital volume) Pulse volume is the difference between the arterial inflow and the venous return during a single heart beat, depends mainly on peripheral resistance and indicates the state of the smallest arteries and arterioles It is a sensitive indicator of sympathetic vasomotor reactivity which is of insufficient degree to show itself in blood pressure changes. Digital volume reflects mainly changes in the filling of the cutaneous capillary and venous plexus which take place over many cardiac and one or more respiratory cycles.

In each patient the vessels have to be relaxed to full vasodilatation before it can be judged whether they are normal or whether diminution in blood flow is organic. This is best accomplished by immersing one extremity in a tank of water at 45 C for 30 minutes and covering the subject with blankets to prevent dissipation of heat. Pulse volume responds before digital volume to relaxation of vasomotor tone

In purely arterial disease body heating will demonstrate a diminution of pulse volume during full vasodilatation while digital volume still responds normally In conditions such as scleroderma and edema, digital volume is more affected than pulse volume

In addition to determining the status of the vascular system the function of the sympathetic nervous system may be appraised by this method Figure 72 was obtained from a patient who had bilateral splanchnicectomy (Smith

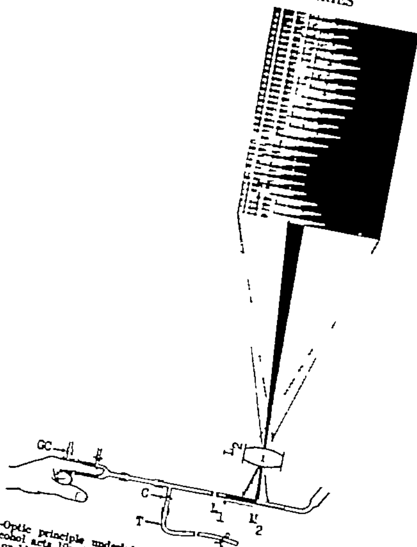


Fig. 71.—Optic principle underlying recording of movements of meniscus. Pipet filled with alcohol acts like biconvex lens and intensifies light, giving the appearance of dark gray or black on film. Pipet containing air behaves to light like two plane-parallel plates: light, therefore, just passes through it, giving light gray shade on film. Meniscus, being curved, reflects light and casts shadow on film; hence the white line between dark and light shades of gray. Calibration on pipet absorbs light and therefore appears as white lines on film; the system is therefore always calibrated whatever the enlargement. *AC* alcohol column in pipet; *C* tap; *T* rubber tubing for adjusting alcohol column; *M* and *M'* menisci of alcohol column, movements of which are recorded; *GC* Gaertner's cuff for applying venous congestion during venous congestion test. (Courtesy of Goetz, R. H. Brit. J. Surg. 37 25-40 July 1949.)

wick's operation). The record shows that the vessels of the right limb remained completely inert and were therefore sympathectomized while those of the left limb dilated in response to body heating as well as to local application of heat. Examination of the operative specimens disclosed that

the second lumbar ganglion was removed on the right side but was missed on the left. Subsequent removal of the left second ganglion resulted in complete sympathetic denervation of the limb Plethysmography is especially useful when

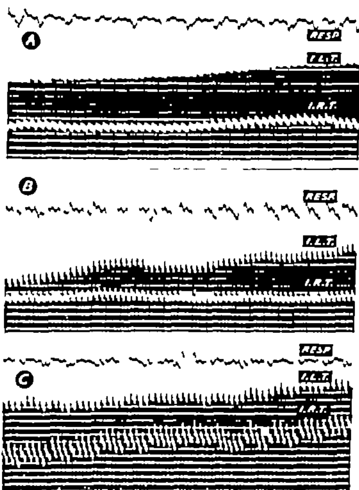


Fig. 72.—Plethysmographic tracing of blood flow simultaneously recorded in two lower extremities in patient who had undergone bilateral Smithwick operation. *A* pulse volume during rest *B* pulse volume after 30 minutes' body heating showing increased pulse volume of left limb (upper record) and lack of response in right; there was release of vasomotor tone in left but not in right limb; *C* after additional application of 10 minutes' local heat pulse volume of right limb is increased indicating that vessels are not organically occluded. (Courtesy of Goetz, R. H. Brit J Surg. 37 25-40 J ly 1949)

symptoms have recurred after sympathectomy or for determining postoperatively the completeness of denervation Skin temperature readings furnish only an indirect index of the peripheral blood flow whereas plethysmography provides quantitative information

The plethysmogram permits measurement of the actual rate of blood flow through digits by means of the venous congestion test Venous return is arrested with a blood pressure cuff, but arterial inflow must not be impeded. When pressure is applied the digital volume increases with each heart beat, first along a straight line, but as the peripheral vascular bed fills the tracing slopes gradually toward the horizontal and eventually runs parallel to the base line. When the pressure is released the tracing usually returns to the original level. The initial rise in digital volume is proportional to, and permits calculation of, the arterial inflow Studies of digital volume and blood flow may also aid in determining the extent of collateral circulation in cases of peripheral vascular disease

Embolectomy from Abdominal Aorta. Hollis L. Albright (Boston Univ) and Field C Leonard[2] (Massachusetts Memorial Hosp) add 3 cases of saddle embolism at the aortic bifurcation to the 190 cases reported in the literature Two of their patients were treated by embolectomy and one by supportive measures including lumbar sympathectomy Amputation of a leg was required in one in whom embolectomy was performed 30 hours after onset. Circulation of the legs was restored in the other two in one without removal of the embolus Of the 193 patients, 144 died as a result of embolism, 26 were cured by direct or indirect embolectomy and 8 by conservative measures, 11 survived after amputation and 4 recovered without any treatment. The authors report one case.

Woman, 65, with an embolism of the left popliteal region of six days' duration, was admitted for third degree burn of the entire left calf and heel caused by an electric heating pad. The ischemic leg had been kept elevated and pulsations were absent from the popliteal artery distally She had been digitalized for six years for rheumatic and arteriosclerotic heart disease with mitral stenosis and auricular fibrillation, without decompensation. Two previous embolisms, one to each leg had occurred without disability

Heparin and dicumarol* were given and a left lumbar sympathetic block with procaine was carried out. On the second day severe pain in both legs, profuse sweating and alarming prostration occurred. A line of demarcation was noted across the lower abdomen below which the skin was of a cadaveric, mottled marble hue. Both femoral pulses and all distal pulsations were absent. Embolectomy

(2) New England J Med. 242:271 277 Feb. 23 1950

was performed 90 minutes later The aorta was exposed through a long left paramedian incision Vigorous pulsations ended at a firm, rounded 3.5 cm. mass at the bifurcation. The aorta was freed and raised only enough to allow passage of a soft rubber Penrose tube beneath it, proximal to the clot. The tube was twisted down on the aorta (Fig 73) just enough to occlude the aorta without damaging its wall A 3.5 cm. incision through the aortic wall was made directly over the embolus and the embolus removed. Catheter suction was applied distally to the iliofemoral arteries bilaterally, with removal of tail clots 15 cm. long The aorta was closed with two interdigitating layers of interrupted fine silk sutures. By the time the abdomen was closed the line of demarcation had receded to midthigh level and femoral pulsations were strong Demarcation had disappeared on the following day Normal pulsations were ultimately restored in the right leg and in the left leg down to the popliteal artery

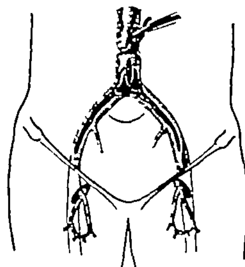


Fig. 73 —Approach to saddle embolus, with complete control of bleeding by twisted soft rubber tubing without use of distal tourniquets. Note clot extending into both iliac arteries. (Courtesy of Albright, H. L., and Leonard, F C.: New England J Med. 242:271 77 Feb. 23 1950)

Subsequent debridement of the left calf burn necessitated removal of the gastrocnemius, soleus and plantaris muscles down to the pulsating posterior tibial artery and the plantar flexor muscles of the foot. A skin graft was applied to the calf, and limited function of the plantar muscles and of the undisturbed extensors returned

Embolectomy is the method of choice for saddle embolus provided the patient is not in irreversible shock. Conservative measures may be combined with, or may follow operation but should not be allowed to postpone it Best results have followed embolectomy performed within six hours of the accident. Longest delays with successful outcomes have been 21 and 23 hours Transabdominal bilateral lumbar sympathectomy at the time of embolectomy may prove advantageous when the patient's condition permits it and the operating time is not unduly prolonged.

Surgical Treatment of Insidious Thrombosis of Aorta. Although reports of thrombosis of the terminal aorta are few Daniel C Elkin and Frederick W Cooper, Jr[3] (Emory Univ) believe that the disease is more prevalent than is assumed. They describe 10 cases

The bifurcation of the aorta is the site where atheromas are most likely to develop often with production of ragged, calcified, ulcer like areas in the intima Thus it is a susceptible point for formation of a thrombus with ultimate narrowing and constriction of the lumen. The predominant symptoms in the authors patients were pain in the hips and legs, easy fatigability and intermittent claudication in the lower extremities. Loss of sustained erection was often an additional symptom. Average duration of symptoms was seven years In all but one instance there was absence of pulsations in the lower extremities and in the abdomen below the umbilicus Thickening and roughening of the nails, loss of hair and moderate pallor on elevation of the lower extremities were noted. Rubor and cyanosis were observed in some instances when the extremities were in a dependent position. Gangrene and atrophy were seen in only three patients Thrombosis is easily differentiated from embolus of the terminal aorta. Changes resulting from severe circulatory insufficiency are noted immediately in the lower extremities after embolus, in thrombosis the changes appear late often years after onset of symptoms In both conditions unless treatment is instituted, gangrene and ulceration are the ultimate result, occurring in a period of days in embolus and after years in thrombosis With any method of treatment prognosis is serious owing to the underlying nature of the disease However certain measures are often of value in improving the circulation and reliev ing the symptoms.

The following procedures are indicated bilateral lumbar sympathectomy, or resection of the bifurcation of the aorta and the thrombosed area When both are used, they may be performed simultaneously However pronounced arteriosclerosis of the bifurcation does not permit clamping with hemostats or obliteration with surgical sutures after division since the vessel tears easily and fatal hemorrhage may

(3) Ann. Surg 130 417-42 September 1949

ensue If thrombosis is extensive and approaches the renal arterial orifices, resection is contraindicated because of the technical difficulty in closing the proximal end of the aorta and simultaneously maintaining function of the renal arteries, in these circumstances, bilateral sympathectomy is indicated

Injuries to Major Arteries and Their Treatment Robert R. Linton[4] (Harvard Univ) states that these injuries are common complications of trauma, especially to an extremity, and may constitute a serious threat to the extremity and even to the patient's life Types of lesions encountered are segmentary spasm, localized contusion and wounds which may be lateral or tangential, perforating and severing The aim of treatment is, first, to preserve the patient's life and, second to secure a normally functioning limb

The first consideration in immediate treatment is prevention of traumatic shock with its accompanying reduction in systemic arterial pressure If there has been great loss of blood, further loss is controlled by digital compression over the bleeding vessel. The wound can then be packed with gauze held in place by a pressure bandage Bleeding vessels in an open wound should always be ligated at the earliest possible moment. If a tourniquet has to be used, the extremity should be kept cool or even packed in ice to reduce tissue metabolism, heat in any form must not be used under any conditions Arterial blood pressure should be returned to normal as soon as possible and maintained so by repeated blood transfusions if possible and no attempt should be made to operate on the patient until this condition is reached and additional blood is available for use during the operation.

General anesthesia is preferable in most cases, and ether by endotracheal tube is the safest and most satisfactory form since oxygen may be given in sufficient amount to combat anoxemia. Incisions must be of sufficient size to expose the vessel proximally and distally to the site of injury and be parallel to and lie directly over the course of the vessel which should first be controlled proximally to the wound and then distally These points of control should be several inches from the site of injury a good clamp for

(4) New York State J Med. 49 2039-2045, Sept. 1, 1949

this purpose is Linton's modification of the Bethune lung tourniquet clamp

If it is necessary to interrupt an artery by ligation, it is generally better to ligate and divide it rather than to ligate it in continuity The blood should be stripped from the artery before ligating it, thereby tying it off as a flaccid tube To ligate a divided artery safely, the ligature should be placed proximally to the point of severance at a distance at least equal to the diameter of the vessel. It is even preferable to use double ligatures on the proximal end, the more distal one being of a transfixion type to prevent slipping off (Fig 74) This requires the sacrifice of an additional length of the vessel With the suture method of closure, it



Fig. 74 —Safe method of ligating a major artery *Left* proximal ligature has been applied, and secondary more distal transfixion ligature is being placed. *Right* artery doubly ligated with sufficient cuff distal to the transfixion ligature to safeguard against its slipping off. (Courtesy of Linton, R. R.: New York State J Med. 49:2039 1949 Sept. 1 1949)

only necessary to utilize 1 2 mm. of the vessel to get adequate hemostasis. The choice of this method at such critical levels as the bifurcation of the common femoral artery may mean the difference between a gangrenous and a viable extremity

Longitudinal tangential wounds of major arteries may be repaired by suturing the edges together with a running everting type of fine nonabsorbable suture, preferably silk, provided not too much of the vascular wall has been destroyed. A transverse wound may also be sutured but again with the same reservation. Age of the patient will determine to some extent whether arterial repair can be performed. If a major artery to a limb must be ligated, the concomitant vein should be interrupted just distal to one of its major branches to enhance the arterial circulation and to avoid the complication of pulmonary embolism.

Generous use of penicillin and, when indicated, streptomycin has reduced infections to a minimum The first injection should be given before the definitive surgery and administration continued at least a week or until all signs of infection have disappeared. Careful administration of heparin, beginning a few hours after surgery, is indicated when the circulation is precarious, if there is no serious soft tissue injury The clotting time should not be allowed to go above 20 minutes, otherwise secondary hemorrhage may develop *If the circulation to the distal part of the* extremity is adequate after 48 hours it is seldom necessary to continue the anticoagulant. It is now considered inadvisable to combine sympathectomy with the definitive surgery, it should be reserved for cases of elective surgery and performed at least 7 10 days previously Intermittent venous occlusion is of considerable value in treatment of acute arterial occlusion, but its value in chronic obliterative arterial disease is doubtful

Traumatic Lesions of Arteries Jere W Lord, Jr[5] (New York Univ) states that evidence of arterial injury demands that the type of damage be determined Marked spasm is occasionally observed which will simulate arterial occlusion Frank damage to an artery may occur in the form of contusion with or without thrombosis, tangential laceration or complete division with or without loss of substance Consideration of the trauma to the extremity will help in deciding the type of involvement the artery has sustained

In spasm of the artery a paravertebral lumbar or stellate ganglion block or intravenous injection of procaine may abolish spasm and restore pulsation. The following case illustrates management of contusion with thrombosis.

Man, 48, in a fall from a moving truck was struck on the anteromedial aspect of the right thigh by a leg of a heavy stove. He had a 2 × ½ in. wound of the thigh which bled profusely The right foot was cold and pulseless. Six hours after injury, the wound was debrided under general anesthesia and the incision was extended from the inguinal ligament to near the knee. After evacuation of clots, the superficial and profunda femoral arteries were found to be contused for a distance of 3 cm. each and solidly thrombosed (Fig 76) The superficial femoral vein was not in-

(5) S Clin North America 30 377 380 April, 1950

jured. Hemorrhage had come from veins and arteries in the adductor magnus and longus muscles which had been completely severed.

The superficial femoral artery was opened proximal to the contused zone after application of rubber-shod clamps. Thrombus was milked out, and a free flow of blood obtained from the proximal end and a feeble one from the distal end. After closure with a continuous everting mattress suture, clamps were released and a good pulsation persisted distally for about 10 minutes and then gradu

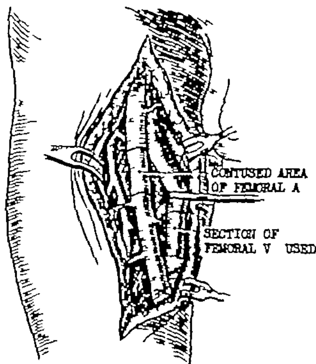


Fig 75.—Sites of contusion of femoral artery and of segment of superficial femoral vein removed for graft. (Courtesy of Lord J W., Jr: S. Clin. North America 30:377 386 April, 1950.)

ally diminished to the point of disappearance. Evidently, the artery was injured to a greater extent than appeared externally A 3 cm. vein graft was then taken from the superficial femoral vein slightly distal to the contused area and, following resection of this area, was reversed and sutured to the ends of the artery (Fig 76) After release of the clamps a strong pulsation was present in the graft and the distal part of the artery The wound was closed without drainage Recovery was satisfactory

Lord calls attention to the relatively frequent arterial emergencies occurring during elective operations and stresses the desirability of prompt repair of the damaged artery He concludes that every operating room should have

a set of basic vascular instruments and sutures in a container which is readily available and the whereabouts of which is known to the nurses on duty In addition, moderate skill in the suturing of arteries and vein grafts should be

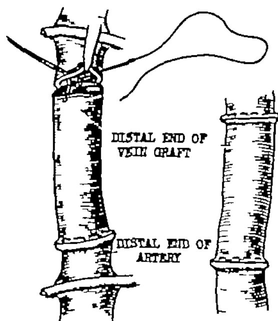


Fig 76.—Ends of vein graft joined to ends of artery by three interrupted everting mattress sutures of 5-0 silk, with anastomosis completed by continuous everting sutures. There is one point of error in the illustration. Thumb forceps should never be applied to the end of a vessel so that the intima is touched and hence traumatized. (Courtesy of Lord, J W J S. Clin. North America 30 377 386 April, 1950)

attained and maintained by repeated practice on animals unless there is a considerable volume of elective vascular material with which to work.

Peripheral Arterial Embolism, with Particular Reference to Evaluation of Conservative Treatment, is discussed by William DeWitt Andrus[6] (Cornell Univ) Seventy two instances of embolism in 65 patients were reviewed. Seven of 10 patients with saddle embolism died, and in each of the three survivors gangrene of one leg developed Embolectomy was performed in one patient who died and in one who survived. Of five patients with iliac embolism four died in two embolism was a terminal event of hypertensive cardiovascular disease Two died of subacute bacterial

(6) Arch. Surg. 60 511-519 March 1950

endocarditis superimposed on rheumatic heart disease in the period before antibiotics were available embolism had resulted in gangrene in one, and the other lived for five days without evidence of critical circulatory impairment

There were 57 instances of embolus in arteries of the limbs in 50 patients In 5 of the 16 who died the embolus occurred so late in the course of cardiac disease that any form of treatment was probably useless 12 had arteriosclerotic cardiovascular disease and four had cardiac lesions on a rheumatic basis, three with an associated subacute bacterial endocarditis. When the embolism was on an arteriosclerotic basis the mortality rate was 52.2 per cent contrasted with a rate of approximately 13 per cent in patients with rheumatic heart disease The incidence of gangrene when emboli involved the limb vessels was 12.3 per cent.

Saddle embolus and iliac embolism are extremely serious complications for they tend to occur in patients in otherwise critical conditions Temporary relief of vascular spasm by procaine sympathetic nerve block should be instituted immediately and sympathectomy should be resorted to in most instances Heparin and dicumarol* therapy should be instituted at once unless embolectomy is planned, when it may be withheld until the close of operation. Anticoagulants may be used for a longer period to prevent further clot formation in the auricle in the presence of fibrillation. Embolectomy may be used in patients seen within 12 hours with femoral or popliteal embolism secondary to old rheumatic heart disease and auricular fibrillation in absence of cardiac decompensation. Embolectomy is also favored when subacute bacterial endocarditis complicates rheumatic heart disease In the elderly patient with generalized arteriosclerosis and arteriosclerotic heart disease embolectomy is contraindicated except in rare cases.

Management of Embolism of Arteries of Extremities is outlined by Theodore B Massell[7] (Los Angeles) who reports experience in the care of 14 peripheral emboli in 10 patients Most peripheral emboli come from the heart, usually from a mural thrombus in auricular fibrillation or

(7) Am. West. Med. & Surg. 3 299-301 September 1949

myocardial infarction, occasionally from endocardial vegetations

Characteristically embolism appears with pain of sudden onset in a cold white limb but pain may be absent during the first 24-48 hours When differentiation is uncertain it is safer to institute treatment for embolism than to withhold therapy because of doubt.

METHOD —The obstruction of the artery must be located before appropriate treatment can be started. Oscillimetric measurement indicates an abrupt change from zero to an abnormally high reading as the cuff is advanced proximally past an embolic obstruction. Localization in regions where the oscillometer cannot be used depends chiefly on palpation of pulses. When there are many emboli localization may be difficult.

When a thrombus lodges at the aortic bifurcation, in the iliac or the femoral artery, embolectomy is the treatment of choice For each case the decision to perform embolectomy depends on the amount of irreversible damage and the relation between anticipated benefits and the hazards of operation Though operation should be carried out promptly, the time which elapses before it is begun may be utilized to treat fibrillation by intravenous administration of digitoxin or avert impending shock by blood transfusion. If surgery must be postponed two or three hours, intravenous administration of heparin may inhibit thrombosis distal to the embolus.

Local anesthesia should be used if the embolus is in one of the peripheral vessels. If it is in the aorta or its iliac branches, endotracheal anesthesia with ether and oxygen is preferred.

Pieces of no. 14 rubber catheter may be applied as tourniquets to control blood flow during arteriotomy They should be applied as close to the embolus as possible, but there should be no patent arterial branch above the clot. The arteriotomy incision should not be placed in the vertical axis of the vessel. The embolus must be removed so far as possible without passing instruments into the vessel lumen. Release of the proximal tourniquet and gentle milking of the arteries will result in extrusion of most of the thrombus. While the artery is being closed the exposed intima should be irrigated frequently with isotonic saline to prevent thrombus formation near the suture line. A continuous silk suture is used for the arteriotomy closure. When the latter is completed and before the tourniquets are removed, 2 or 3 cc. heparin solution is injected into the isolated segment of the artery *The distal tourniquet is then removed* and the suture line tested for gross leaks. Oozing may be controlled by gentle tamponade with a moist sponge. Use of special hemostatic agents may lead to thrombosis at the suture line Little additional trauma and only a few minutes' operative time are required for performance of lumbar sympathectomy along with an aortic or iliac embolectomy In other sites, periarterial sympathectomy near the operative site may decrease reflex vasospasm

Postoperative care of embolectomized patients is similar to the conservative regimen preferred for embolism of the upper extremity or below the knee In the sympathectomized patient additional dilator measures are contraindicated. Vasoconstrictor paralysis may be produced in those not sympathectomized by an injection of bromsalizol® (monobrom hydroxy benzyl alcohol) into the appropriate sympathetic ganglion. The effect lasts 10-14 days and is preferable to intermittent vasodilatation produced by a series of sympathetic blocks. No vasodilating drug is an adequate substitute for sympathetic blocks or section but of those available priscoline® seems most useful Use of heparin and dicumarol® to prevent secondary thrombosis may be an important factor in decreasing incidence of gangrene after embolism. Ideally the patient should be kept in an oscillating bed until all danger of gangrene is past. If a fibrillating left auricle is the source of the embolus, an attempt should be made to convert it to a normal rhythm by administration of quinidine. Whether a normal or fibrillating rhythm is obtained dicumarol® should probably be administered for the duration of the patient's life

In Massell's series nine emboli were removed and five were treated without operation There were no deaths after four aortic or iliac embolectomies Death occurred in two of four patients on whom femoral embolectomy was performed

Arterectomy in Treatment of Intractable Pain Following Recovery from Acute Arterial Occlusion. N E Freeman F H. Leeds and R E Gardner[8] (Univ of California) report 10 cases of acute occlusion of a major artery by thrombosis or embolism in which the extremity was viable but intractable diffuse pain and distal hypoesthesia with a protopathic pain response subsequently developed The pain was continuous and subject to severe spontaneous exacerbations This pain has been termed ischemic neuritis. Some patients found relief in grasping the foot and gently rocking back and forth in bed dependency did not seem to help the pain. Walking appeared to ease it, but most patients stated that exercise was prevented by intermittent claudication All complained of numbness in the involved member The pain was relieved temporarily by lumbar sympathetic block. The site of obstruction was visualized by arteriography All but one patient underwent operative removal of the thrombosed segment. After operation the severe spontaneous pain was relieved though other types

(8) Am Heart J 38 320 335 September 1949

been performed in the past Minimal gangrene is best treated by amputation of one or more toes or by McKittrick's transmetatarsal amputation These procedures should never be done until the level of gangrene has been clearly established and it appears probable that the resulting wound will heal Crushing of appropriate peripheral nerves may be of value with some painful open lesions

[When considering the effect of smoking as an etiologic factor it would be interesting to know something about the duration of smoking instead of merely the amount at the time of questioning. For example, in the case of bronchogenic carcinoma it seems that a long period of smoking (about 20 years or more) is of great importance in the etiology of the lesion.—Ed.]

Lumbar Sympathectomy for Arteriosclerotic Gangrene. Leon Gerber William S McCune and William Eastman[1] (George Washington Univ) report cases of 19 patients with late peripheral arteriosclerosis and necrotic phenomena who were treated by enucleation of the second and third lumbar ganglions and the intervening sympathetic nerve trunk. Nine patients also had diabetes mellitus Denervation resulted in improvement and healing of the necrotic area in 14 cases In the remainder failure was evidenced by progression of the necrosis which necessitated amputation

Preoperative sympathetic block with procaine hydrochloride *indicated the expected operative effect in* most patients, but it was not uniformly dependable A negative effect with sympathetic block did not necessarily indicate the operation would be a failure

There seemed to be no specific relation between the results obtained and presence or absence of diabetes

Arteriosclerotic Popliteal Aneurysm Report of 14 Patients Treated by Preliminary Lumbar Sympathetic Ganglionectomy and Aneurysmectomy Robert R Linton[2] (Harvard Univ) shows that incidence of this type of aneurysm has been increasing particularly in the past decade if untreated, it constitutes a serious threat to viability of the extremity and even to life He treated 14 patients from 1942 to 1947 by a two stage procedure including preliminary lumbar sympathetic ganglionectomy (first, second and third lumbar ganglions) followed in about 10 days by aneurysmectomy Ages ranged from 49 to 79 (average 65)

(1) Arch Surg 59 1234 1243 December 1949
(2) Surgery 26 41 58 July 1949

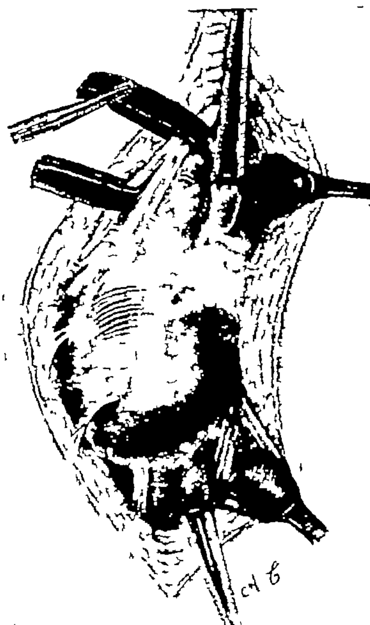


Fig. 77 —Aneurysm and sciatic, common peroneal and posterior tibial nerves, the nerves retracted with wide but thin rubber bands. Note tourniquet clamps on popliteal artery proximal and distal to aneurysm. Popliteal v in lies on aneurysmal sac, to which it is intimately attached. (Courtesy of Linton R. R. Surgery 6 41 58 July 1949)

Ether inhalation anesthesia was used for the sympathectomy performed through the flank type of incision described by Smithwick Spinal anesthesia was preferred for the aneurysmectomy

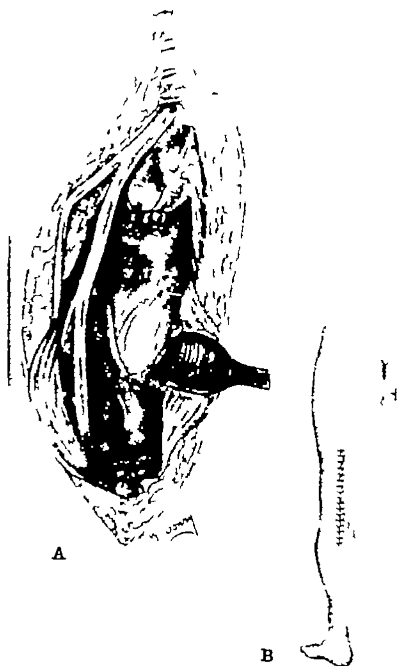


Fig. 78.—*A*, operative field with aneurysm removed, great nerves intact, proximal and distal ends of popliteal artery and vein doubly ligated, and *B*, incision closed without drainage with fine interrupted cotton or silk sutures to popliteal fascia and interrupted vertical mattress silk sutures to skin. (Courtesy of Linton, R. R. Surgery 26:41-58 July 1949.)

TECHNIC.—Adequate exposure of the aneurysm and its main afferent and efferent arteries is essential and is best obtained by a vertical incision which overlies and parallels these vessels and extends into the thigh and upper part of the leg Towels are sutured to the skin edges The sciatic, common peroneal and posterior tibial nerves are dissected free and the popliteal artery is exposed proximal to the aneurysm, with care not to damage the superior genicular arteries if they arise above the aneurysm, and also the highest genicular artery Modified Bethune lung tourniquet clamps (Fig. 77) are applied to the popliteal artery about 2 cm. proximal and distal to the aneurysm and the vessels are occluded during the remainder of the dissection. The aneurysmal sac is dissected free by developing a cleavage plane between it and the tissues of the popliteal space. The popliteal vein as a rule is intimately adherent to and sometimes incorporated in the posterior wall of the aneurysm (Fig 77) No attempt is made to preserve it unless it lies free. The proximal and distal ends of the popliteal artery and vein are ligated with nonabsorbable material, the vessel being ligated first and then a transfixion ligature placed in the cuff distal to the primary ligature. An alternate method is to close the end of the popliteal artery with two rows of a running suture of 0000 arterial silk to save the collateral vessel which arises within 1 cm. of the end of the artery After final inspection, the wound is closed in two layers without drainage (Fig 78) Interrupted sutures of fine silk or cotton are used in the popliteal fascia, and the skin is closed with interrupted vertical mattress sutures of silk. The latter type of suture is important to prevent contracture in the scar at the crease in the popliteal space. A posterior molded plaster splint is applied to the thigh and leg to keep the knee in extension. Bilateral superficial femoral vein interruptions are recommended to prevent pulmonary embolism.

Thirteen patients and their extremities survived (93 per cent) and one patient died after the sympathectomy (7 per cent) All patients' extremities functioned normally after operation. Eleven patients were well two months to five years after discharge from the hospital. One patient died of cirrhosis 1 year later and one died after 14 months of rupture of an arteriosclerotic common iliac aneurysm.

Problems in Dynamics of Blood Flow Conditions Controlling Collateral Circulation in Presence of Arteriovenous Fistula, Following Ligation of Artery are discussed by Emile Holman[3] (Stanford Univ) On establishment of a femoral fistula in a dog the arteries both proximal and distal to the fistula were narrowed a phenomenon comparable to reduction in heart size when bilateral fistulas were opened.

(3) Surgery 6 889-917 December 1949

When an arteriovenous fistula was established in the main vessels of the stump of a limb previously amputated the artery proximal to the fistula was dilated and varying degrees of collateral circulation developed When the fistula was located at the end of an artery, or if there were no branches between the fistula and the ligated end of the artery, collateral circulation was not increased If one or more branches lay between the end of the artery and the fistula, the lessened resistance to retrograde flow through these distal branches resulted in extensive collateral circulation Since potentially ischemic tissues beyond the fistula had been removed by amputation, collateral circulation could not be attributed to a chemical stimulant as postulated by Lewis, nor to tissue needs as suggested by Reid

A large fistula without constriction of either proximal or distal arteries provided the most effective stimulus for dilatation of the artery proximal to the fistula and for development of collateral circulation Dilatation of the proximal artery was prevented by application of a band which limited the volume flow of blood through it When easy access to the site of low resistance introduced by the fistula was blocked by ligation of the distal artery, collateral circulation did not develop In dogs in which arteries proximal or distal to the fistulas were not ligated or constricted the extent of collateral circulation depended on duration of the fistula *Ligation and division* of the femoral artery in one limb produced a minimal collateral circulation beyond the ligation as compared with an extraordinary enlargement of the collateral circulation in the other limb containing an arteriovenous fistula The latter indicates that blood in the aorta was deflected more readily into the limb with lessened resistance due to the fistula than into the limb in which peripheral resistance had been increased by ligation of its main artery

If easy return flow to the heart was blocked by application of a band to the vein proximal to the fistula, arterial flow was directed through the fistula into the distal vein and resulted in progressive edema of elephantiasic type When the vein proximal to the fistula was widely patent the edema which immediately followed production of a fistula subsided at the same time that prominent super

ficial veins with greatly increased venous pressure appeared. Disappearance of the edema was probably due to dilatation of the main proximal venous channels so that the increased arterial flow could be drained off promptly

End pressure at a given point in a large artery is the pressure produced when the forward thrust of the flowing blood is suddenly blocked at that point by ligation. When the artery is ligated, end pressure is suddenly converted into lateral pressure whose magnitude depends on the location of the ligation in the arterial tree and is directly proportional to the peripheral resistance beyond that point. The collateral circulation which develops after ligation of a large artery depends on transformation of end pressure into lateral pressure, which is directed into its branches and results in an increased volume flow through them. This increased volume flow distends them and opens up their prearteriolar and arteriolar beds. The flow is then directed into the prearteriolar beds of the branches distal to the ligation in which the pressure is low because of ligation. For this reason blood flows through them more readily than through prearteriolar beds elsewhere and collateral circulation is established.

Experimental and Clinical Use of Vein Grafts to Replace Defects of Large Arteries is reported by Julian Johnson, Charles K. Kirby F E. Greifenstein and A. Castillo[4] (Univ of Pennsylvania) In 17 healthy mongrel dogs, 1-4.6 cm. segments of vena cava between the renal and iliac veins were excised and adjacent ends ligated. Segments of adjacent abdominal aorta were then excised and replaced by the vena cava graft, using Carrel's suture technic Five dogs died during the postoperative period because of excessive anesthesia or respiratory complications, but there was no evidence in any of the 17 dogs of leakage or thrombosis of the graft at autopsy or when killed.

At a secondary operation performed 13 days to 14 months later on the surviving animals, there was a slight increase in the diameter of the longer, but not of the shorter, grafts There was no evidence of aneurysmal dilatation, and all grafts functioned well After removal of the grafts, thickening of the graft wall was apparent on gross examination.

(4) Surgery 26 945-956 December 1949

Microscopic studies showed that there was a progressive increase in fibrous tissue in all layers of the graft wall. In none of the animals were changes in circulatory dynamics demonstrable in femoral artery pulse pressure tracings.

In two patients with tetralogy of Fallot, superficial femoral vein grafts were utilized to bridge defects between the subclavian and pulmonary arteries. Pulmonary embolism caused the death of one patient on the fifth postoperative day, but autopsy disclosed that the vascular anastomoses were intact and the vein graft appeared to have been functioning well. When the second patient was last seen one year after operation, arterial oxygen saturation was 94 per cent (preoperatively, 75 per cent), and he could walk 5 miles without dyspnea

Circulatory Changes in Foot after Lumbar Sympathectomy R. B Lynn and H. Barcroft[5] (London) recorded skin temperature and blood flow changes in 21 feet preoperatively, daily for six days postoperatively and for one to three months after sympathectomy Average blood flow in six feet with normal arteries was 2.1 ml./100 cc /minute preoperatively, reached a maximum of 20 ml. on the second postoperative day, was 8 5 ml. on the sixth day when vascular tone had partially recovered and was 4.9 ml. one to three months after operation. Preoperatively the temperature of the toes averaged 24 2 C , postoperatively they were still warm (32.2 C) after one to three months The blood flow in 13 feet with abnormal arteries also increased postoperatively returning to about double the normal. The toes also remained warm.

Lack of Return of Vascular Tone in Feet after Sympathectomy—Lynn and Peter Martin[6] discuss a patient with bilateral testicular atrophy and chronic ulcers of the legs in whom an "erythermalgic like' state developed after lumbar sympathectomy because of failure of vasomotor tone to return to the feet. Such anomalous behavior cannot be explained.

Blood flow in the feet increases after sympathectomy because of the vasodilatation which follows release of the vessels from central vasoconstrictor tone The reason why

(5) Lancet 1 1105-1108 June 17 1950.
(6) Ibid., pp. 1108-1109

the maximum is not achieved until the first or second day after sympathectomy is unknown. It is of interest that the average maximal blood flow in the foot after sympathectomy was only about half that found by other observers in sympathectomized hands Recovery of vascular tone is not due to re-establishment of a central nervous connection through some slightly damaged pathway

Comparison of Sympatholytic Effects of Priscoline,* Etamon* and Dibenamine in Dogs with Results of Actual Sympathectomy F A. Marzoni, M J Reardon, J P Hendrix and K. S Grimson[7] (Duke Univ) found that the effectiveness of these drugs approaches that of sympathectomy In proper doses they produced comparable reduction of blood pressure and block of the carotid sinus reflex. Increased amounts further reduced blood pressure to definite shock levels, block of the pressor responses to anoxia and to stimulation of the central end of a divided vagus nerve then occurred

Clinically, priscoline* seemed to be the most easily administered and regulated of the three drugs 50-75 mg every three to four hours decidedly increases peripheral circulation, even though this dose range is insufficient to block completely the response to epinephrine, does not significantly reduce systemic blood pressure-altering reflexes caused by cold or breath holding, nor significantly reduce blood pressure in the supine or erect position. Since 50-75 mg is required to increase circulation in extremities, 125-175 mg to produce epinephrine blockade and 150-200 mg to block reflexes and reduce blood pressure, the desired therapeutic effect can be obtained by regulating the dose Thus far amounts over 75 mg have been used only for test purposes. Apparently of the three drugs, priscoline* alone in low doses has this ability to produce peripheral vasodilatation at a level below that necessary for adrenolysis or sympatholysis, as judged by systemic arterial blood pressure responses.

Dibenamine is similar to priscoline* in its adrenolytic property and may be somewhat more effective as a systemic sympatholytic agent Effective doses produce a gradual drop in blood pressure, and the effects of the drug last many

(7) Surgery 26:117 130 July 1949

hours. Although prolonged action may be advantageous under some circumstances, treatment of possible adverse reactions might be difficult in the absence of an effective antidote. Also, although there is some evidence that the drug may be given by mouth, its clinical use has been limited to the intravenous route. Pituitrin® partially restores blood pressure reduced by priscoline® and dibenamine.

Use of etamon® for circulatory disorders is limited by accessory effects produced by its general ganglionic blocking action. Examples are loss of accommodation of the eye, decrease or cessation of peristalsis throughout the alimentary tract and alteration of function of the urinary bladder. Such parasympathetic blocking side effects do not occur after the two adrenolytic and sympatholytic drugs. Etamon® is not adrenolytic. Reduction of blood pressure occurs promptly after intravenous administration of amounts necessary to produce sympatholytic or parasympatholytic effects. Abrupt reduction of blood pressure may not be desirable, particularly if the cerebral or coronary arteries are severely diseased. Prostigmin® restores blood pressure reduced by this drug and also reflexes which it has blocked.

Effect of Priscoline,® Papaverine and Nicotinic Acid on Blood Flow in Lower Extremity of Man. Comparative Study was made by Ralph A. Murphy, Jr., John N. McClure, Jr., F. W. Cooper, Jr. and Lawrence G. Crowley[8] (Emory Univ.). The subjects were normal young men and women with no evidence of cardiovascular disease. To measure the effect of these agents on blood flow in the legs, venous occlusion plethysmography, skin temperature measurements, Burch-Winsor plethysmography and radioactive sodium removal from the gastrocnemius muscle were utilized.

These tests disclosed that an increased blood flow occurred for three to five minutes after administration of priscoline,® but a comparable increase could not be demonstrated after giving papaverine and nicotinic acid. No significant change in blood pressure or pulse rate was demonstrated. Increased peripheral blood flow after priscoline® administration may be due to changes in cardiac output, although studies of this in seven subjects gave highly variable results. It may follow splanchnic vasoconstriction, coincident with periph

(8) Surgery 27 655-662 May 1950

eral vasodilatation, with a shift of blood to the periphery

Of the 27 normal persons given the three drugs, only 2 showed a significant increase in rate of sodium removal, denoting indirectly an increased blood flow in muscle The most consistent and greatest decrease in sodium removal was observed in those given priscoline* Apparently skin and subcutaneous blood flow is increased at the expense of blood flow in muscle by some shunting process after administration of the vasodilating drug A similar effect is produced by sympathetic block or sympathectomy These results suggest that the effect of a vasodilating drug, sympathetic block or sympathectomy in increasing blood flow is centered mostly on vessels of the skin and subcutaneous tissue The increases in blood flow following administration of priscoline* were not comparable to those produced by nerve block. It is emphasized that these results in normal persons must be applied cautiously in the treatment of peripheral vascular disease

Release of Vasoconstriction by Vasodilator Drugs and Sympathetic Nerve Block Experimental and Clinical Study In normal young men and women without cardiovascular disease, Lawrence G Crowley, Ralph A Murphy, Jr., and F W Cooper, Jr[9] (Emory Univ) determined blood flow changes in response to intravenous injections of various drugs and to sympathetic nerve block by means of skin temperature variations, total toe volume and mean pulse volume changes The subjects were allowed to relax for 30 minutes in a room at a constant temperature of 78 F Skin temperature and plethysmographic measurements were obtained before cooling the room to 68 F and the various drugs were injected In the five subjects who received nicotinic acid, none of the three methods revealed any evidence of release of the induced vasoconstriction. Four of the six subjects given injections of papaverine showed a brief, slight rise in mean pulse volume and total toe volume, but none of the group had a rise in skin temperature All of six subjects who received priscoline* showed definite evidence of release of vasoconstriction to some degree Block of the posterior tibial nerve in six subjects with 10-20 cc of 1 per cent procaine resulted in pronounced release

(9) Surgery 27 679 88 June 1950

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(8) Surgery 27 653-662 May 1950

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(9) Surgery 27 8 6-857 June 1950

of vasoconstriction, as shown by skin temperature rise, total toe volume and mean pulse volume increases Only one subject in the priscoline* group exhibited vasodilatation equal to that of nerve block.

Priscoline* was administered to four patients with organic occlusive arterial disease and two with Raynaud's disease None of those with occlusive arterial disease showed any significant vasodilatation in the diseased extremity but the opposite extremity exhibited considerable release of vasoconstriction. Most patients with Raynaud's disease showed significant release of vasospasm in the fingers, noted a sensation of warmth which extended into the fingers and toes and had complete relief from pain in the finger tips which had been evoked by exposure to cold.

As a result of these clinical and experimental observations, the authors conclude that priscoline* should not be used for treatment of organic occlusive arterial disease but that it may be beneficial in functional vasospastic disorders such as Raynaud's disease

[Will this and perhaps newer and better drugs make sympathectomy obsolete in the treatment of Raynaud's disease?—Ed.]

Some Experiences Concerning Use of Tetraethylammonium in Diagnosis and Treatment of Peripheral Vascular Diseases P Windfeld[1] (Sonderborg) used tetraethylammonium (TEA) in thromboangiitis obliterans and dysbasia arteriosclerotica Skin temperature was measured by thermoelectric apparatus Treatment was started cautiously with 100 mg intravenously, but it was soon discovered that to obtain an effect 500 mg was often necessary Nevertheless, administration of 100 mg was continued as a test dose During injection the patient tastes metal shortly afterward paresthesia appears in the hands and feet. Vision sometimes becomes blurred from loss of accommodation. The hands and feet begin to feel warm 15-20 minutes after injection (often several hours after intramuscular injection), this sensation may persist for 48 hours. The *spasms* in the calves decrease considerably, and the patient can walk much farther than before injection. A fall in blood pressure is concomitant with injection, but blood pressure soon rises again and no signs of collapse or of subjective

(1) Acta chir Scandinav 98:118-120 1949

inconveniences are noted Only in two elderly arteriosclerotics with diabetes was it necessary to give up TEA because of collapse, which, however, rapidly disappeared after ephedrine injection.

In a few patients, no rise in temperature could be obtained, although they had a subjective sense of heat and the dysbasia was partially relieved Perhaps TEA was stopped too soon, yet, according to Smithwick, there is a small group of patients in whom all attempts at blockade give a negative result, whereas sympathectomy may have a surprisingly good effect. In one case TEA had a directly noxious effect in curtailing the blood flow in the more distal parts of the leg, with aggravation of the gangrene of the toes

There are still many unsolved problems in treatment of peripheral vascular diseases To avoid unpleasant surprises, it is wise to demonstrate by some test, before sympathectomy, that there is also a vasospasm and that the circulation can be improved by release of the vasospasm TEA is well suited for the purpose It is a valuable supplement to the methods used in investigation of peripheral vascular diseases because it produces an autonomic blockade with greater certainty In many cases it stops the pains of causalgia and post traumatic states and diminishes dysbasia in thromboangiitis and arteriosclerosis, making sympathectomy unnecessary

Factors Affecting Diameter of Large Arteries with Particular Reference to Traumatic Spasm. The factors chosen for more detailed study by J B Kinmonth F A. Simeone and V Perlow[2] (Harvard Univ) fell under two headings (1) those acting directly on the vessel, such as changes in blood pressure mechanical trauma, or the possible effect of vasomotor nerves (2) nervous factors acting reflexly from other parts of the body The first group was studied in cats and rabbits by direct observation of the diameter of the femoral artery with concomitant limb volume records by plethysmography Reflex arterial spasm was studied particularly in rabbits in a series of tourniquet experiments in each of which the behavior of the right femoral artery and limb volume was studied in response to a tourniquet applied

(2) Surgery 26:452-471 September 1949

to the left thigh, first on animals with an intact nervous system and later on animals in which parts of possible nerve reflex pathways had been excised

Results of the experiments indicated that changes in femoral artery diameter follow release of a tourniquet applied to the thigh for from 2½ 7 hours However, it appears that these changes are purely passive The diameter varies in direct proportion to systemic arterial blood pressure Furthermore these changes occur regardless of whether the systemic or the sympathetic nerves to the limb are intact or ablated

The concept of reflex spasm in large arteries was tested on the efferent segments of the possible reflex arc Stimulation of the decentralized lumbar ganglionated trunk produced plethysmographic shrinkage of the paw without shrinkage of the femoral artery Direct electric stimulation of the femoral artery and its adventitia produced no change in caliber of the vessel. If the femoral artery were part of a reflex arc these procedures would affect its caliber

Criticism of administration of additional anesthetic agent during the experiment is reasonable since both nembutal* and ether may themselves produce a change in femoral artery diameter as a result of their effect on systemic blood pressure

The reported experiments suggest that, although the femoral artery is not under direct control of the nervous system, it can alter its size on a myogenic basis (stretch) and as a passive reflection of systemic blood pressure.

A curious phenomenon was that, after positive stretching of the artery by a rise in systemic blood pressure induced by adrenalin,* the artery wall suddenly relaxed and assumed a new resting position reminiscent of the mollusk adductor with its ratchet device The behavior of the arterial diameter subsequently followed the various stimuli in the usual manner but from its new resting level.

PERIPHERAL VENOUS SYSTEM

THROMBOEMBOLISM

Maintenance of Fluidity and Coagulability of Blood Physiologic and Surgical Aspects Leandro M Tocantins[3] (Jefferson Med. College) states that the fluidity of blood is maintained by a dynamic equilibrium between two opposing groups of factors within and in contact with the blood. Anticoagulant factors are rapid circulation, intact vascular endothelium (or surfaces like silicon, collodion or paraffin), anticephalin (antithromboplastin) antithrombin and fibrolysin (as profibrolysin) Coagulant factors are slow or stagnant circulation, damaged vascular endothelium (or surfaces like glass or clay) cephalin (platelets, leukocytes, tissue cells) prothrombin Ac globulin and fibrinogen. Heparin is not mentioned because, as such it is not present in the circulating blood

When normal blood is shed from the vessels into the tissues or on a surface like glass, disruption of the finely adjusted equilibrium between coagulant and anticoagulant factors follows almost immediately and results in clot formation followed by clot retraction. Blood clots of certain persons may liquefy and disappear within one hour of being formed this involves the interaction of three components present in the clot (fibrin, profibrinolysin and antifibrinolysin) and one kinase found in the tissues and certain micro-organisms (streptokinase)

Conflicting results and interpretations of measurements of the rate of blood coagulation stem principally from the use of glass tubes defective collection of blood (cutaneous blood obtained from a cut in the skin of a finger is unsuitable) and single determinations. When blood is properly collected and placed in collodion or silicon-coated tubes, it remains fluid three to five times as long as in glass.

For two years, Tocantins collected blood with silicon coated syringes and measured clotting time in three silicon coated tubes in the first tube blood was undiluted and

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(3) S. Clin North America 9 1535-1548 December 1949

in the second and third it was diluted 40 and 70 per cent respectively This made it possible to observe the behavior of the blood on a surface designed to preserve its fluidity and to note the effect of disruption of the balance between coagulants and anticoagulants caused by dilution

If a patient has a tendency to thromboembolic disease, it is well to discourage blood stasis in the venous circulation to avoid constrictive dressings and appliances, to divert blood to the deep veins by applying fairly tight bandages from the ankle to just above the knee, if there is already too much stasis in superficial veins, and to improve blood flow when necessary with digitalis, mercurial diuretics or sodium depletion diets as indicated. If the patient is bleeding excessively, blood stasis is to be encouraged, at least in the involved area.

The two commonest causes of delay in the rate of blood coagulation are diminutions in prothrombin and in platelets A less common cause is an increase in antithromboplastin. The most rapid way of correcting prothrombinopenia is with transfusion of blood or plasma. Vitamin K should also be given to aid production of prothrombin. In most instances 2-5 mg orally or parenterally daily suffices. A platelet deficiency can best be combated temporarily by transfusion of fresh unmodified blood, if a direct transfusion cannot be given, the next best resort is a transfusion of freshly citrated blood. To overcome hypercoagulability of blood, two measures are available (1) increase the anticoagulant content of blood by administering an inhibitor such as heparin which has an antithromboplastin and antithrombin action (2) reduce the effectiveness of coagulants with dicumarol,* which interferes with formation of prothrombin and thereby makes less thrombin available for clotting The patient receiving anticoagulants must be under close observation to make reasonably sure that the desired fluidity of blood is actually obtained and that there is no excessive bleeding

Newer Concepts of Blood Coagulation, with Particular Reference to Postoperative Thrombosis, are discussed by Alton Ochsner John H. Kay Paul T DeCamp Samerhill B Hutton and George A. Balla[4] (Tulane Univ) Thrombin

(4) Ann Surg. 131 652-668 May 1950

is probably necessary for conversion of fibrinogen to fibrin of good tensile strength. This suggests that phlebothrombosis may not occur unless thrombin is present to a greater or lesser degree intravascularly Since thrombosis does not occur in every patient who has been subjected to trauma, such as an operation, it is likely that the released thrombin may be inactivated by circulating antithrombin. Circulating antithrombin may be alpha tocopherol which is normally present in the alpha globulin and gamma globulin fractions of blood However, alpha tocopherol, when added to plasma becomes bound by fibrinogen and other proteins and does not act as an antithrombin unless a trace of calcium is added to the plasma.

A study of 201 surgical patients disclosed that if antithrombin levels were 1 32 or higher and continued at these levels, intravascular clotting did not occur Incidence of thrombosis or fatal pulmonary embolism in patients with antithrombin levels below 1 16 and prothrombin values shorter than 20 seconds who received alpha tocopherol alone was approximately the same as in a control series Alpha tocopherol and calcium were used prophylactically in 34 patients, none of whom had antithrombin levels less than 1 16 There were no cases of clinically demonstrable thromboses but there was one death from pulmonary embolism. There was evidence that the patient with pulmonary embolism had extensive phlebothrombosis before operation. Although maintenance of a high antithrombin level may prevent development of new thrombi, it will not prevent detachment of a previously formed clot All patients who are likely candidates for a venous thrombosis must be carefully watched to detect early evidence of thromboembolism so that procedures such as venous ligation may be instituted to prevent death.

Alpha tocopherol acetate may be given by mouth or intramuscularly and calcium should be furnished in 10 cc doses of 10 per cent calcium gluconate every 48 hours and given intravenously

Study of Certain Aspects of Blood Coagulation in Postoperative State, in Congestive Heart Failure and in Thrombophlebitis Noble O Fowler[5] (Univ of Cincinnati) studied

(5) J Clin. Investigation 28 1-478 July 1949

29 unselected postoperative patients for evidence of accelerated coagulation by means of six tests which were run simultaneously 19 showed acceleration by the Waugh Ruddick test, 10 acceleration in lusteroid tubes, 6 increased heparin tolerance, 5 shortening of whole plasma prothrombin time, 3 shortening of the 12.5 per cent plasma prothrombin time and 3 acceleration by a modified Lee-White test. The same tests repeated on seven of these patients later in their postoperative courses in some showed persistence of hypercoagulability on the twelfth postoperative day Results of the different tests did not correlate The only patient in whom thrombophlebitis subsequently developed had normal results in all tests. Three other patients with thrombophlebitis showed acceleration of coagulation in lusteroid tubes and shortening of whole plasma prothrombin time dilute plasma prothrombin time and Waugh-Ruddick test result were normal.

Of 27 patients with congestive heart failure 25 of whom were receiving digitalis, only 1 showed acceleration of coagulation in lusteroid tubes, and 2 showed acceleration in the Lee-White test. Fourteen patients were given 25 mg heparin intravenously 10 minutes later blood samples were drawn almost simultaneously from the arm vein into which the heparin had been injected and from a vein in the opposite arm. In six of these patients clotting time was significantly longer in the sample taken from the vein receiving the heparin than in the sample taken from the opposite arm.

The authors draw the following conclusions. Hypercoagulability of the blood is a frequent occurrence in the postoperative state and may persist as long as 12 days after operation. The correlation among the tests used is poor, suggesting that they are concerned with different factors involved in the clotting process. It was impossible to predict which postoperative patients were going to develop venous thrombosis In performing the heparin tolerance test and similar tests in which a substance is injected intravenously and a sample of blood is later drawn for analysis, it is advisable to draw the blood from a vein of the opposite arm because the vein into which the substance was injected probably retains a larger proportion of that substance than is found in the general circulation. Of the tests

studied, the Waugh Ruddick heparin retarded coagulation test appears the most sensitive However, its lack of specificity would seem to indicate that it is of no value in predicting or diagnosing thrombophlebitis

Cause and Prevention of Peripheral Circulation Thrombosis with Special Consideration of Peripheral Circulation. Wilhelm Weidenmann[6] (Berlin) states that to understand thrombus formation it is necessary to recall certain facts concerning the blood in health. Most important in the clotting of blood, as well as in thrombus formation, are the platelets They are very sensitive and disintegrate readily, which is their function, for when they die they liberate thrombokinase from which fibrin is formed They have an ameboid motion and tend to gather in clumps Blood clots when it comes in contact with foreign bodies or damaged tissue A dense net of fibrin is formed and in the interstices lie blood cells and serum. Fibrin is an albuminous substance deriving from plasma its parent is fibrinogen, present in normal plasma The change of fibrinogen, a product of the liver into fibrin is brought about by thrombin, which is produced through activation of prothrombin by thrombokinase The latter is present in most tissues blood cells and platelets A further requisite for the changing of prothrombin to thrombin by liberated thrombokinase is presence of ionized calcium.

There are three outstanding theories regarding thrombus formation (1) chemical processes in the blood (2) mechanical processes in blood and vascular system, and (3) neurologic influences on the entire vascular apparatus

1 The presence of calcium in the blood is essential for clotting if it is precipitated out, clotting fails to occur Slight shift to acidity increases calcium ionization slight alkalinity retards ionization. Also the essential enzyme, thrombokinase, is activated, leading to speedier clotting In thrombopenia and thrombopathies thrombi rarely occur, whereas thrombocytosis and increased agglutination of platelets are often associated with thrombosis. The influence of the pancreas on clot formation has been demonstrated. Trypsin activates prothrombin to thrombin as readily as thrombokinase if calcium ions are present. Trypsin injec

(6) Zentralbl f Chir 73 566-573 1948

tion clots the circulating blood, and mercurial diuretics have similar effects

2. The mechanical form of clotting is presumed to be due to solid elements in the blood, fibrin is precipitated and gathers around them. A warning is given in regard to danger in intravenous therapy on this account. A second mechanical factor in thrombus formation is retarded circulation Thrombi tend to form in veins near the surface of the body where there is no muscle support. The effect of toxic endothelial damage on the condition of venous walls also plays a part. *All diseases associated with increased* erythrocyte sedimentation rate favor development of clots.

3 The influence of the nervous system on the vascular system may also be related to thrombus formation. The sympathetic nerves act on metabolism, causing acidosis. The striking effect on the peripheral vascular system of blocking of the sympathetic is evidence of this influence. Injections of sympathicotonic preparations like acetylcholine and neostigmine cause marked fluctuations in the prothrombin index. Blood pressure effects on blood flow and muscle tone also are related to thrombus formation.

The generally accepted treatment of thrombosis is administration of heparin and dicumarol.* Leeching and scarification have some value Special attention must be given the peripheral circulation, where osmotic and metabolic changes take place, for it may be the site of capillary damage in serious diseases Heparin and dicumarol* are valuable in preventing and treating thrombosis, but the circulatory and metabolic disturbances at the periphery must also be corrected.

Prevention of Venous Thrombosis and Pulmonary Embolism by Electric Stimulation of Leg Muscles V L Tichy[7] (Cleveland) points out that during operation the patient's leg muscles are paralyzed by anesthesia after operation the patient moves his muscles little for a day or even several days, and during this time legs and feet are sometimes immobilized with firm bed coverings. Medical patients are often similarly immobilized. The legs pressing on a firm operating table or mattress can often be seen to assume a

(7) Surgery 26:109-116 July 1949

triangular cross section, especially in undernourished per sons with soft muscles. Under these conditions, not only are the veins compressed but trauma occurs which may be di rect to all the tissues, including the veins, and aggravated by interference with circulation in capillaries, venules and veins Since the anterior leg veins are only rarely the seat of the original thrombosis, it seems that a combination of trauma and stasis is necessary for formation of thrombi and their growth. In view of these facts, it seemed that stimulation of blood flow immediately after operation or even during prolonged operations would reduce the inci dence of leg vessel thrombosis and that a sinusoidal type of current would give a good reaction without undue dis turbance of the patient. A stimulus given to the calf mus cles 30 times a minute for 30 minutes, with a 30 minute rest period, and continued for at least 24 hours was decided on, and there has been no reason to change this during the course of the experiment since early in January 1947 In a few cases treatment has been prolonged for two days. Some patients had a short massage of the leg muscles while still on the operating table and this should be done to all. Stimulation sufficient to contract the calf muscles so as to move the foot slightly was the objective.

The results in over 800 cases are encouraging Many patients were in the older age group Close supervision of the technicians is necessary especially when narcotics are used. An important factor is beginning the treatment as soon as the patient is returned to the ward. There are no absolute contraindications to use of this therapy, but cau tion must be exercised in patients with impaired arterial circulation. Results thus far indicate that a striking drop in incidence of leg vein thrombosis can be expected

Dicumarol* in Experimental Thrombosis Knud F Jansen and Erik Tage Hansen[8] (Univ of Copenhagen) found that they could regularly produce thrombosis of the inferior vena cava in rabbits by treating 1 cm. of the vessel with crystalline silver nitrate at autopsy three days later, a fixed massive thrombus filled and distended the vein for 1.5-2.5 cm., and below the treated area a secondary throm

(8) Acta chir Scandina 98 152 156 1949

bus extended into the iliac veins but was not adherent to the walls of the vein and did not obliterate the lumen. The silver nitrate also produced pronounced aseptic inflammation followed by necrosis

Dicumarol* in doses corresponding to those used in patients was administered before operation as a prophylactic measure (group 2a) and after operation as a curative measure (group 2b) Most animals in group 2a died on the first or second postoperative day as a result of bleeding into the abdominal cavity Autopsy revealed a small thrombus only in the area treated with silver nitrate, it adhered to the vascular wall and partially obliterated the lumen In group 2b only 1 of 13 rabbits had a thrombus extending into the *distal part of the vein, in the others the thrombus* was limited to the treated area and did not completely occlude the lumen. In animals which did not die soon, the thrombus was organized and recanalized. In two animals killed on the tenth day it was impossible to find even a microscopic trace of thrombus in the vein, although the usual reaction in the vascular wall had followed the silver nitrate treatment.

The authors conclude that dicumarol,* by its anticoagulant effect, is a potent agent in preventing secondary thrombosis, even if it cannot arrest thrombus formation at the beginning

Pulmonary Embolism Statistical Study of Postmortem Material at Massachusetts General Hospital, covering the five year period, 1943-48, during which 1,929 bilateral femoral vein interruptions were done and covering two control periods, 1931-36 and 1936-40 is presented by Benson B Roe and Joel C Goldthwait.[9] The total number of autopsies in each period averaged about 1,900 Incidence of massive fatal pulmonary embolism was 1.9 and 2.7 per cent in the control periods and 3.5 per cent in the period when ligation was carried out. The steady increase of deaths from pulmonary embolism despite venous interruption can be explained on the basis of the relative decline in other diseases and complications with the advent of chemotherapy blood banks, improved technics and the increasing number of older patients in the hospital census.

(9) New England J Med. 241:679-684 Nov 3 1949

Ten patients who had bilateral femoral vein interruption either superficial or common, in the 1943-48 period and who also had an anatomic diagnosis of fatal pulmonary embolism at autopsy were particularly studied. There was nothing remarkable about the age sex, primary disease or type of operation. There were no cases of congestive heart failure. Venous interruptions were performed prophylactically in four patients and therapeutically in six. These 10 patients represent a mortality rate of 0.5 per cent in the total group of 1,929. The 4 prophylactic interruptions represent an 0.5 per cent mortality among 871 prophylactic interruptions.

Of 92 deaths from pulmonary embolism in the 1943-48 period, 49 (53 per cent) occurred without any clinical warning. There was evidence of thrombophlebitis or pulmonary infarct in 25 (27 per cent) of the 43 remaining patients, but records on the other 18 were incomplete or absent.

Approximately 20 per cent of all fatal pulmonary emboli occurred below age 50. Analysis based on the primary disease and operation showed that massive fatal pulmonary embolism occurs in a wide variety of diseases, but that the majority complicate surgical disease and occur postoperatively. Diseases such as uterine fibroids, hernia and breast lesions, in which treatment has been fairly standardized for many years, show an apparently constant incidence of embolism. Fatal emboli follow a wide variety of operative procedures. The increased number after gastrointestinal tract resection is probably accounted for by the increase in patients who have such operations. A decrease after operations on the bladder and prostate is attributed to femoral vein interruption.

It is evident that the incidence of pulmonary embolism is affected by a complex array of factors. A five year large scale program of femoral vein interruption has failed to alter significantly the mortality in pulmonary embolism compared with earlier similar periods. Mortality statistics alone are not a satisfactory criterion for evaluating a procedure. Clinical analysis of selected patients demonstrated that more favorable results are obtained with femoral vein interruption.

Pulmonary Embolism Evaluation of Policy for Prophylaxis and Therapy has been made by Donald V Baker, Jr., Richard Warren, John Homans and David Littmann[1] (Veterans' Admin. Hosp, West Roxbury, Mass) Anticoagulants were administered for prophylaxis and therapy in all patients except those with definite pulmonary infarct. Venous interruption was used for these and for others needing treatment but in whom anticoagulants were contraindicated.

Of the 104 patients in whom pulmonary embolism developed, 30 had fatal embolism proved by autopsy in 27 Clinical evidence for fatal embolism was unmistakable in the other three, on whom autopsy was not done Among the 17 patients in whom thrombi were found as possible sources of embolism, only 6 could logically have been saved by femoral vein interruption, of these, 4 had massive embolism. Since there were in all only 7 cases of massive embolism as opposed to 20 of the smaller cumulative type, this finding suggests that venous interruption is more useful in protecting against massive than multiple embolism

Diagnosis was made before autopsy in only 33.3 per cent Clinical, x ray and electrocardiographic findings were uniformly disappointing With present inadequate diagnostic methods any treatment to protect the majority of patients must be instituted on prophylactic grounds.

Death from pulmonary embolism occurred in one case despite adequate use of dicumarol® and in four despite superficial femoral vein ligation Fatal embolism occurred in nonsurgical or medical patients eight times more frequently than in postoperative patients.

[This and the preceding study are very welcome and important. From them certainly one cannot conclude that prophylactic ligation of the femoral vein has any decisive influence in preventing fatal pulmonary embolism.—Ed.]

Phlebothrombosis of Lower Extremities Critical Factors in Evaluating Sites of Femoral Vein Section are discussed by L. H. Eisendorf[2] (Vancouver Wash.) A study of 42 cases disclosed that phlebothrombosis can be divided into five stages as an aid to clinical management. Embolization can occur during any stage but the threat is greatest in stages III and IV

(1) New England J Med. 242 923 928 June 15 1950
(2) Am. J Surg 78 431-445 October 1949

In stage I the thrombus is usually in the muscles of the calf and less commonly in the plantar and adductor muscles. It may have progressed up to but not into the popliteal veins. Usually there are no symptoms, but palpation of the muscles and plantar aspect of the foot may disclose tenderness. There may be temperature elevation and tachycardia in some cases. This stage may be termed the "golden period" of treatment.

In stage II thrombosis progresses into the popliteal and lower femoral veins. It is usually a propagating, floating mass which is not adherent to or obstructing the femoral vein. Temperature elevation, tachycardia, and sedimentation rate elevation are common. Homans' sign can usually be elicited. Mild cyanosis of the lower extremity in a dependent position may be evident.

The thrombus progresses further as a loose, propagating mass in stage III with only partial obstruction of the femoral vein. It may or may not be adherent to it. In stage IV it extends well into the iliac vein, to which it may be adherent but is usually nonobstructive There may or may not be associated thrombosis in the deep femoral system. In these stages all the previous findings are apparent, as well as dilated veins, particularly on the anterior aspect of the leg edema of lower extremities, particularly on dependency, and cyanosis There may be coldness of the extremities due to associated arterial spasm and with it sweating, tingling of the legs, rarely numbness and redness Occasionally thrombosed superficial varicosities will be noted, suggesting associated deep phlebothrombosis.

In stage V the clot adheres to the entire femoral vein, fully obstructing it and the internal iliac vein. An inflammatory reaction develops, accompanied by lymphangitis, resulting in an acute femoroiliac thrombophlebitis. Vasospasm is quite evident and is associated with pain and redness along the femoral vein. Chills, fever, leukocytosis and elevated sedimentation rate are common This stage represents the so-called phlegmasia alba dolens or milk leg

For stages I IV phlebothrombosis without pulmonary embolism, anticoagulant therapy should be used. Vein resection may be done if early diagnosis is made, if anticoagulant therapy is ineffective or contraindicated or if

embolism occurs In stages III and IV phlebothrombosis, with anticoagulants contraindicated, without embolism, femoral vein section with proximal and distal thrombectomy is recommended The superficial or common femoral vein is ligated, depending on the site and amount of clot. Distal thrombectomy helps reduce postoperative edema.

Regardless of the stage of thrombosis but exclusive of acute femoroiliac thrombophlebitis, once a pulmonary embolism has occurred the only safe thing to do is to carry out common femoral vein section preferably below the saphenous vein It is unwise to section only the superficial femoral vein even if a thrombus is not demonstrated at the level of phlebotomy In these cases about 12 hours after common femoral vein section anticoagulant therapy is instituted The patient is carried on heparin until there is an adequate dicumarol* effect shown by a sufficient depression of the prothrombin level of the blood

Stage V phlebothrombosis is treated by paravertebral lumbar sympathetic blocks, heat drugs such as etamon* that block autonomic impulses, anticoagulants, general supportive measures and chemotherapy

Bilateral femoral vein section should be performed only if there is evidence of phlebothrombosis in each extremity Actual positive findings in one extremity should be treated as described However, the opposite leg should be watched closely and ligation withheld until evidence of phlebothrombosis develops

Measures for preventing phlebothrombosis are reduction of weight if the patient is obese, correction of anemia, elimination by injection or surgical resection of major varices in the lower extremities, medical supervision of cardiac abnormalities, adequate diet and physical activity preoperatively gentle handling of tissues at surgery, prevention of stasis in leg veins during convalescence elevation of the foot of the bed and leg exercises postoperatively Active prophylactic measures should be carried out in patients with a history of previous thromboembolism disturbances of venous circulation malignancy extensive abdominal and surgical procedures fractures of the femur and amputations of the lower extremities, cardiac in

sufficiency and obesity More than 60 per cent of all post operative venous thromboses and emboli occur in those over age 50

Phlegmasia Cerulea Dolens and Gangrene Associated with Thrombophlebitis. Michael DeBakey and Alton Ochsner[3] (New Orleans) state that the occurrence in venous thrombosis of the extremities of clinical manifestations so severe as to simulate acute arterial occlusion and even terminate in gangrene is extremely uncommon Review of the recent literature reveals 56 cases, in 24 of which gangrene developed. They report two cases which represent the two types of the disease pseudoembolic phlebitis, the so-called blue phlebitis or phlegmasia cerulea dolens of which 32 cases have been reported, and venous thrombosis with gangrene of the extremity

Most of the reported cases of the first type, like that of the authors, follow a fairly consistent pattern. The clinical manifestations come on suddenly and progress rapidly, and consist chiefly of excruciating pain located first in the calf or groin but eventually involving the whole limb, edema with cutaneous blebs and even bullae, deeply violaceous or cyanotic and often purpuric discolorations, and vascular impairment in which the pulsations of the arteries of the extremity become diminished and may disappear entirely Clinical symptoms of circulatory collapse often accompany or immediately follow onset of the condition and are likely to be impressive Most cases have occurred in the third to fifth decades and in the left lower extremity No particular circumstance seems to predispose to its development though some type of infection is often present Death occurred in eight cases, in most soon after onset of the condition. The course of patients who recover is fairly characteristic of phlegmasia alba dolens or the commoner form of iliofemoral thrombophlebitis

The early course of the second form may suggest a typical thrombophlebitis or phlegmasia alba dolens with subsequent development of fairly characteristic arterial manifestations, or the sequence of events may be reversed. In all cases, regardless of onset, the violaceous discoloration of the

(3) Surgery 6 16 29 July 1949

limb becomes more intense until typical gangrene gradually appears, usually in the toes and distal portion of the foot Occasionally, bilateral involvement has been observed, as in the authors' case Death occurred in 11 of the 24 recorded cases, and in all but 3 of the remainder a major amputation of the extremity was necessary, in those 3, as in the authors' case only a portion of the foot and toes was lost

Conservative measures, such as use of vasodilator drugs and procaine hydrochloride block of the regional sympathetic ganglions or periarterial sympathectomy, and operative intervention consisting of exposure of the femoral vessels thrombectomy and periarterial sympathectomy, have been advocated, but none has been strikingly successful

It would appear that sudden complete blockage of the circulation by venous thrombosis is the primary factor in the mechanism of this ischemic disturbance, vasospasm probably plays a secondary and contributory role in the pathogenesis of the condition

Thromboembolic Complications in Surgical Patients In 1946 Charles K. Kirby and William T Fitts, Jr [4] (Univ of Pennsylvania) instituted a regimen of routine prophylactic measures sympathetic block, anticoagulants or surgical interruption of involved veins, in an attempt to decrease thromboembolic complications Comparison of incidence over a three year period with that from 1925 to 1945 disclosed no decrease in fatal pulmonary embolism. This was particularly true in elderly patients who were confined to bed because of severe operation or illness However early ambulation and greater attention to prophylactic measures may have reduced the incidence of fatal embolism in patients undergoing major operations on the stomach, biliary tract, colon, rectum, prostate and bladder The absence of pulmonary infarction in 59 patients with deep vein thrombosis and of subsequent fatal embolism in 24 patients with nonfatal pulmonary infarction suggests that use of proximal vein ligation and anticoagulants in these patients effectively prevented further complications.

In 1946 it was hoped that more frequent and careful

(4) Surgery 27 564 571 April 1950

examinations of the legs might reveal a higher incidence of clinical warning signs of thrombosis. Between 1941 and 1946 there was no warning of fatal embolism in 71 per cent and in the present series in 82 per cent. The unheralded occurrence of fatal embolism in most instances has been the experience of other authors

Since there is usually no warning deaths from pulmonary embolism must be prevented by an effective mass prophylaxis, such as early ambulation, anticoagulation and proximal vein ligation, or by laboratory tests which will detect the imminence or presence of thrombosis while there is still time for adequate protective treatment. The experience of Kay and Ochsner in a small series with a new test in which the prothrombin and antithrombin levels are followed daily during the postoperative period suggests that the danger of thrombosis may be reliably demonstrated by this means They have found that administration of alpha tocopherol pre- and postoperatively to increase antithrombin activity may prevent postoperative thrombosis and embolism.

[The curious multiple venous thrombosis which often occurs as a complication of carcinoma of the tail of the pancreas and sometimes in association with carcinoma of the stomach needs explanation. I am not familiar with even one careful study of either prothrombin or antithrombin levels. —Ed.]

Postphlebitic State

Postphlebitic Leg Results with Femoral Vein Interruption. S Thomas Glasser[5] (New York Med. College) treated 71 patients with superficial vein interruption immediately distal to the profunda branch. In 20 the procedure was done bilaterally In managing these patients careful general physical examination is essential to rule out diseases such as polycythemia, myxedema, cardiac and renal disorders, arteriosclerosis obliterans, intrathoracic or intra-abdominal malignancy, which might cause edema or venous thrombosis of the legs

Most patients were between ages 40 and 60 The ratio of women to men was 2:1. Usually association of the primary thrombophlebitis with a specific illness was impos-

(5) Surg., Gynec. & Obst. 89:541-546 November 1949

sible, but in 43 patients duration of the postphlebitic state was 5 20 years

Ulcer occurred as a complication in 58 cases It was excised, and split skin grafts were used in 20 This procedure was done before femoral interruption in eight cases with but two successful results When done after femoral ligation in 12 there were 10 good results, indicating that successful skin grafting is unlikely unless venous stasis is relieved

The second and third lumbar ganglions were removed to overcome associated vasospastic phenomena and improve arterial blood flow to enhance healing of the ulcer In eight cases the ulcers had been refractory to interruption of the femoral vein but were greatly benefited by sympathectomy In 24 cases sympathectomy was performed before femoral ligation, with good results in 12 In the others healing followed femoral vein ligation Lumbar sympathetic blocks with novocain* were used in 40 cases before femoral vein ligation. Swelling was reduced in 21 and pain relieved in 28 Sensory nerve block of the long saphenous nerve in 10 limbs, the sural nerve in 3 and the superficial peroneal in 1 successfully allayed the pain of indurated cellulitis or ulceration

The saphenous vein was ligated at multiple sites after femoral interruption in 12 cases healing resulted in 9

There was no mortality in the series, and morbidity was negligible Pain along the distal course of the femoral vessels lasted 4-10 days in nine cases. This was attributed to a spontaneous aseptic thrombosis occurring in the femoral and popliteal veins after operation. Moderate postoperative edema was present in 12 cases but subsided in one week. Paresthesia over the inner aspect of the knee persisted 7 10 days in 28 It probably resulted from operative manipulation of the internal femoral cutaneous nerve or may have been associated with the inflammation which was part of the healing process

Of three patients followed for five years and three for four years, only one had a recurrent ulcer Of eight followed two years the incidence of ulcer recurrence was 50 per cent. Among 22 followed one to two years, 6 had recurrent ulcer In most instances recurrence was associated

with trauma It was apparent that femoral vein ligation had a favorable effect on eczema Epidermophytosis was the commonest cause of unsatisfactory response of eczema

Femoral vein ligation is the one therapeutic measure which is essential in treatment of the postphlebitic state

Pathology and Treatment of Postphlebitic Leg and Its Complications Josephus C Luke[6] (Montreal) succeeded in obtaining retrograde venograms in 18 of 28 cases of post phlebitic chronic edema associated with ulceration or eczema of the lower leg In 10 cases the injection was technically imperfect or the common femoral vein could not be found by venipuncture The degree of venous changes seen, from valvular damage only to almost complete obliteration of the vein by organized thrombus seemed to have little bearing on the occurrence degree and extent of the post phlebitic complications, consequently the role of the damaged vein in producing these complications is believed to be slight and ligation of the femoral vein does not seem a logical treatment.

In ligation the large lymphatic channel running on the anterior half of the upper femoral vein is usually carefully separated and retracted But on one occasion Luke inadvertently cut this vessel and the edema of the lower leg later was much more persistent and extensive than that normally seen after vein ligation for phlebothrombosis In acute thrombophlebitis with its marked inflammatory involvement of the vein wall and perivenous structures, the lymphatic trunks are invariably involved by inflammatory and later scar replacement Luke believes that interference with lymphatic return is the greatest single etiologic factor and venous retardation is secondary Entrance of pyogenic organisms through superficial trauma in such a leg is the immediate cause of the complications.

Luke has made an attempt to group such cases into four types for the purpose of treatment those that are associated with secondary incompetent varicose veins, those with evidence of sympathetic overactivity in the leg those with marked soft tissue sclerosis about the ulcer and the group in which these factors are not present. The forms of therapy used are only aids in healing of the complications giving

(6) Canad. M. A. J. 61:270-273 September 1949

also some measure of protection against recurrence, but the greatest single factor in keeping the leg free of trouble is adoption of a new way of life which includes wearing an elastic stocking, resting the leg regularly, keeping it elevated when possible and avoiding irritation and trauma.

Venous Pressure in Primary and Post-thrombotic Varicose Veins Study of Statics and Dynamics of Venous System of Lower Extremity under Pathologic Conditions. Using direct and indirect methods, I. O Højensgård and H Stürup[7] (Copenhagen) determined venous pressure in 16 men and 10 women with primary varicose veins and in 12 men and 7 women with varicosities secondary to previous thrombosis of the deep veins of the lower extremities In both groups venous pressure in the standing position was about equal to the hydrostatic pressure If incompetent saphenous veins were not compressed there was no fall in pressure during walking When these veins were compressed the pressure fell considerably in patients with incompetent primary varicosities, whereas in most of those with post thrombotic varicose veins (group A) there was no fall, whether the veins were competent or not In a few post thrombotic patients (group B) walking with saphenous compression produced some fall in pressure This group differs from group A in that during Perthes' test there is some emptying of the varicosities When coughing or straining was used to increase intra abdominal pressure, pressure in the incompetent saphenous vein increased greatly in both groups without application of venous compression This increased pressure was not usually transmitted through compressed saphenous veins, competent communicating or competent saphenous veins

It was concluded that effective occlusion of an incompetent primary varicose saphenous vein will re-establish normal conditions if the communicating veins are competent. There will be total emptying of the varicose veins during Perthes' test. Group A post-thrombotic patients will show little change after occlusion of saphenous veins, and there will be no emptying of the veins during Perthes' test. Venous return will be variably improved by occlusion of the vein in group B post-thrombotic patients Occlusion

(7) Acta chir Scandinav 99 133-153 1949.

of a competent saphenous vein may aggravate venous insufficiency Phlebography and venous pressure estimations are usually unnecessary to determine therapeutic indications, Perthes' test is sufficient in most cases.

VARICOSE VEINS

Varicose Veins Further Findings Based on Anatomic and Surgical Dissections With many others, R Stanton Sherman[8] (Univ of California) believed that failure of high ligation of the long saphenous vein was due to incompetent

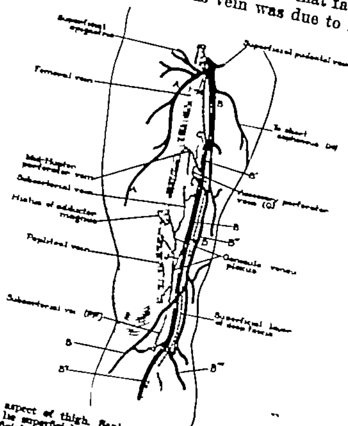


Fig. 79 —Medial aspect of thigh. Saphenous veins, *A* *A*, *B*, *B'*, *B''* and *B'''* Veins *A* *A* and *B* lie superficial to deep fascia, whereas distal to *C* veins *B'* and *B''* lie beneath superficial layer of deep fascia. *B'''* emerges from beneath deep fascia at *D* Constant mid-Hunter canal perforator vein connects main saphenous vein *B'* with femoral vein. Genicular venous plexus connects femoral and popliteal veins with subsartorial vein, which makes connections with main long saphenous vein *B''* in thigh and continues distally in leg to make connections with *B''* *B'''* and posterior tibial vein. Accessory perforator vein *Q* emerges into superficial fascia without making direct connections with main saphenous stem *B'* *B''* Perforator vein *J* makes direct connection between main saphenous stem *B''* and subsartorial vein. Line *M* illustrates danger of mistaking superficial vein *A* for main long saphenous vein in patients with double long saphenous veins. (Courtesy of Sherman, R. S. Am. Surg. 130-218 232 August, 1949)

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(8) Am. Surg. 130 218 32 August, 1949

thigh perforator veins, but surgical dissections convinced him that these perforators are not as frequently incompetent as was previously accepted He therefore investigated the perforators distal to the knee Dissections on 63 cadavers (92 legs) and observations on 482 patients (901 lower

Fig 80 —Medial aspect of leg. Saphenous systems B'' B''' and short saphenous vein. Secondary saphenous tributaries B''' are black and their placement in superficial fascia is indicated. Lightest cross hatching indicates veins beneath traditional deep fascia. Medium cross hatching (vein B'' and lower part of short saphenous vein) depicts veins lying between extension of deep fascia of thigh and traditional deep fascia. Perforator veins 3 4 and 5 connect posterior tibial vein with main long saphenous vein B'' Perforator veins 1 and 2 connect posterior tibial vein with secondary saphenous veins B''' Perforator 6 connects posterior tibial and subsartorial veins with veins B'' and B''' Accessory perforator vein Q emerges into superficial fascia without making direct connections with vein B'' All measurements start from sole. (Courtesy of Sherman, R. S.; Ann. Surg 130 218-232 August, 1949)

extremities) showed that incompetent leg perforators are numerous and much more often responsible for incomplete therapy than the thigh perforators.

Anatomic placement of perforators in the lower extremity may be divided into five main groups (1) those of the medial aspect of the extremity (2 and 3) those of the lat

eral aspects of leg and foot (4) the short saphenous system, (5) muscular perforators of the calf (Figs 79-82) Three principal findings resulted from the anatomic dissections (1) the main long saphenous vein (B') in the leg and foot courses distally adjacent to the medial border of the tibia

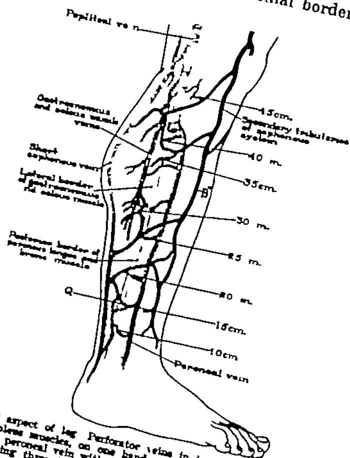


Fig. 81 —Lateral aspect of leg Perforator veins in intermuscular septum between gastrocnemius and soleus muscles, on one hand, and peroneal muscles on other Perforator veins connect peroneal vein with secondary saphenous tributaries B''' Perforator vein L is emerging through lateral border of gastrocnemius or soleus muscles. Connections between perforator and muscular veins are indicated. Accessory perforator vein Q emerges to connect with secondary saphenous tributary B''' at different site than companion perforator vein. All measurements start from sole. (Courtesy of Sherman, R. S. Ann. Surg 130 218-232 August, 1949)

and is situated deep to a distinct fascial layer continuous with the deep fascia of the thigh, (2) the lower part of the short saphenous vein although superficial to the traditional deep fascia of the leg is also deep to the fascia which is a continuation of the deep fascia of the leg (3) the perforators of the leg and foot are numerous and, in general fit into a rather easily established pattern

Successful treatment of incompetent perforator veins depends on a full understanding of the patterns and especially of the characteristics of the saphenous tributaries *B*, *B'*, *B''*, *B'''*, the mid Hunter canal perforator system, the

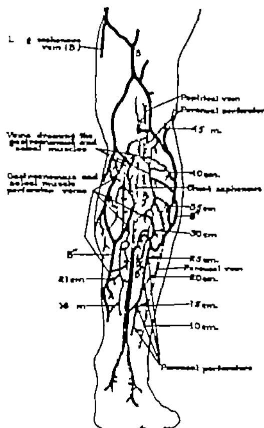


Fig 82.—Posterior aspect of leg Composite drawing showing sites of perforator veins. Perforators connect short saphenous vein and secondary saphenous tributaries *B'''* with veins draining gastrocnemius and soleus muscles. In general, there are four longitudinal lines of perforators two are within 2 cm. of either side of midline and other lines are 3 cm. or more lateral or medial to midline. There are usually four or more perforators in each of three medial lines and only one or two in lateral longitudinal line. In latter group absence of perforators is compensated for by drainage through peroneal perforator veins. Arrows indicate site of perforators. Note perforators indicated at *16* and *21 cm.* They might be confused with perforator *1* or *2* as shown in Figure 80 All measurements start at sole. (Courtesy of Sherman, R. S. Ann. Surg 130 218-232, August, 1949)

genicular plexus and the anatomic distribution of perforator veins in the leg The surgical procedure based on the anatomic studies has improved results of therapy of varicose veins. It consists of a combination of injection of veins, high ligation, elimination of the main saphenous stem (*B'* *B''*), eradication of the mid Hunter canal perforator vein, elimi

nation of incompetent perforators connected with the genic ular venous plexus and excision of all incompetent perforators in the leg or foot Judicious use of a sclerosing solution, to suppress hemorrhage especially in the lesser saphenous tributaries is helpful at time of operation The futility of the stripping procedure or eversion of the long saphenous vein by the Babcock probe method is evident. Operating time for one extremity is about three hours Usually both extremities are treated simultaneously, making the presence of at least one additional competent surgeon advisable

Sherman does not believe that incomplete filling of veins in 30 or more seconds as observed when the Trendelenburg test is positive indicates absence of incompetent perforators in the leg or thigh. Indeed, in about 95 per cent of surgically treated cases the Trendelenburg test was positive and in 823 of 901 extremities obvious pathologic perforator veins were found. Number of incompetent perforators in an extremity varies the largest number found was 14 and the smallest 1

Since 1944 surgery based on adequate knowledge of perforator veins in the leg has given successes ranging from 98 6 per cent after one year to 97.8 per cent after three years in 311 legs Failure to achieve perfect results can usually be traced to one or more, usually small, incompetent perforators overlooked at operation. Average hospitalization was 2 14 days and average time to return to work 15 days Ace bandages are worn until all edema subsides, about six weeks

[This excellent study is another demonstration of the fact that there are opportunities for fundamental research still to be done in many of the most common conditions whose nature is often considered to be thoroughly understood and settled. Doubtless a thoughtful study of so unglamorous a subject as hemorrhoids would reveal some hitherto unsuspected truths. Truth is beauty even when it concerns a hemorrhoid.—Ed.]

Problem of Adequate Therapy for Varicose Veins New Procedure Theodore B Massell[9] (Birmingham Veterans' Admin. Hosp., Van Nuys, Calif.) states that most poor results of high saphenous vein ligation are due to failure to interrupt incompetent perforating veins These veins can not be detected preoperatively by the usual tourniquet

(9) West. J Surg 58 11 115 March, 1950

tests However they can be localized accurately by phlebography and successfully ligated.

PROCEDURE.—Three lengths of 3/8 in gum rubber tubing are applied as tourniquets just above the ankle and knee and high on the thigh. The ankle tourniquet is snug enough to obstruct the superficial but not the deep venous circulation, while the others hinder but do not obstruct the deep venous return With the patient supine, 25-30 cc. of 35 per cent solution of iopyracyl is injected into a vein on the dorsum of the foot, and anteroposterior and lateral films are taken of the leg The tourniquet above the knee is removed and the leg is elevated while cassettes are changed An anteroposterior film is made of the thigh. The other tourniquets are removed and a film is made of the pelvis.

At operation, a conventional high saphenous vein ligation is performed without retrograde injection. Mobilization of the proximal end of the vein is carried through the fossa ovalis until the saphenofemoral junction is visualized and all subfascial tributaries are divided. Using the phlebogram as a guide, vertical incisions are made over the sites of incompetent perforating veins. The fascia is incised and undermined and varicosities are divided beneath the fascia. Incisions are 2 12 cm. in length and are planned to give access to as many perforators as possible. Finally the long saphenous trunk is avulsed down to the ankle by means of an intraluminary stripper If the short saphenous vein is incompetent, it is also stripped out. Incisions are closed in layers with interrupted fine cotton sutures. When there are tissue changes due to prolonged venous stasis, meticulous care is required to achieve accurate approximation of wound edges without strangulation. The extremity is wrapped with an elastic bandage from toes to groin and ambulation is started on the day of operation.

In 79 limbs of 57 patients treated by this method, there has been persistence of significant varicosis in only 2 immediately after operation in 1 the phlebogram was unsatisfactory and should not have been used as a guide for operation. About 25 per cent of the patients have been followed over 18 months in none have there been significant recurrences of varices There were no serious postoperative complications.

Varicosities of Lesser Saphenous Vein. In 515 consecutive cases of varicose veins of the lower extremities which were secondary to valvular insufficiency and in which operation was done Walter W Carroll[1] (Northwestern Univ) found 60 instances of primary venous reflux in the lesser saphenous vein necessitating ligation for correction (11 6 per cent)

(1) Arch. Surg 59 578 587 September 1949

Of these, 44 were handled by ligation of the lesser saphenous vein alone Therefore after evaluation of the thigh the lesser saphenous vein should be examined from the posterior aspect of the calf with the patient standing on a high plat

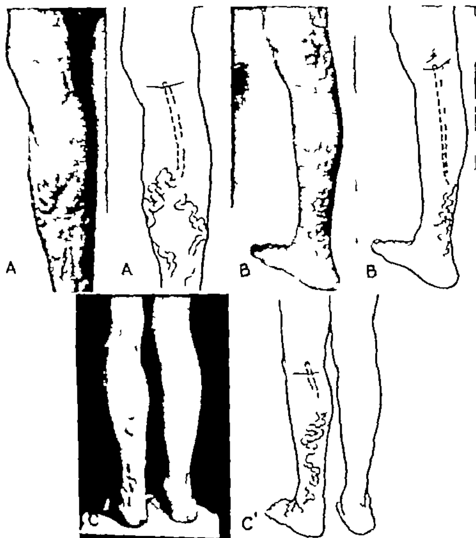


Fig. 83 —Varicosities from primary venous reflux in lesser venous system. (Courtesy of Carroll W W Arch. Surg 59 578 587 September 1949)

form. A smooth upper calf with varicosities starting midway down and extending toward the heel and around to the lateral aspect of the ankle and dorsum of the foot should raise immediate suspicion (Fig 83) Any distal varicosities which seem to have no obvious relation to the medial tributaries

of the greater saphenous vein should be suspect. Also suspect are varicosities which persist after previous adequate ligation of the greater saphenous vein, provided there is conclusive proof that there are no anteromedially located incompetent perforators When the knee is slightly flexed and the weight borne by the opposite extremity, upper calf and popliteal space are relaxed enough for the vein to be palpated, if a firm venous trunk is felt at or just below the transverse crease in the skin, it must be considered significant. Repeated compression of the lower varicosities which communicate with this trunk may aid in finding the vein through the upward transmitted impulse (modified Schwartz test) Once its discovery has placed the vein under suspicion, the principles of the tourniquet tests can be applied.

METHOD —The veins are emptied by elevation of the leg and a section of soft rubber tubing is applied to the lower third of the thigh to control any possible reflux through the greater saphenous system (if this is necessary) The popliteal space is compressed with the thumb while the fingers take a firm grip on the anterior aspect of the knee to stabilize the compression. The patient then is allowed to stand and thumb compression is maintained for 20-30 seconds. If the veins do not fill, the source of the reflux has been found, and this is verified by removing the thumb compression and noting that the varicosities immediately fill from above down. The tourniquet around the thigh is left in place throughout this procedure.

Ligation of the vein and its tributaries at the popliteal junction corrects the pathologic reflux and causes a more efficient rerouting of venous return. The transverse incision is more physiologic and anatomic, heals well and allows adequate exposure of the vein and its branches, it must be placed 1-3 cm. above the crease Immediately after operation the patient is encouraged to walk. A firm elastic roller bandage from toes to lower thigh helps give temporary support and adds compression to the healing wounds. When ligation of the great saphenous vein also is planned for the same leg Carroll has found it advisable to postpone the procedure in the groin until later

Venous Pressures in Saphenous System in Normal Varicose and Postphlebitic Extremities Alterations Following Femoral Vein Ligation. Richard Warren Eugene A. White

and Charles D Belcher[2] (West Roxbury Mass.) studied 102 extremities to discover whether determinations of venous pressure in the saphenous vein in the erect resting and walking positions, as performed by Beecher and Seiro might serve as a more accurate Perthes test for venous function in the lower extremity The method used was that of Moritz and von Tabora (Fig 84)

METHOD.—A venipuncture is performed in one of the saphenous veins of the calf or one of their tributaries with a 20 gauge needle

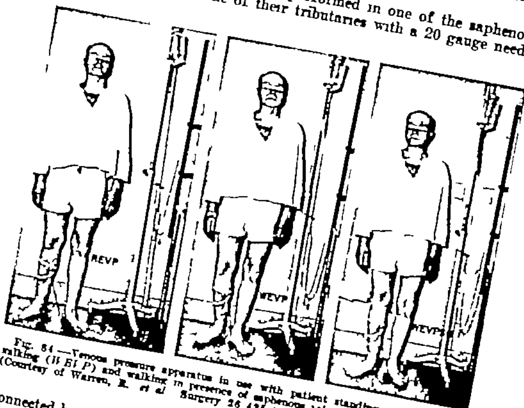


Fig. 84.—Venous pressure apparatus in use with patient standing still (REVP) walking (WEVP) and walking in presence of saphenous vein occlusion (WEVPSO) (Courtesy of Warren, R. et al Surgery 26 435-445 September 1949)

connected by a 6 ft. rubber tube to an elevated reservoir of physiologic saline which is allowed to drip continually into the vein except while pressure readings are being made. A side arm in the middle of this tube leads to a manometer consisting of a glass tube 60 cm. long with 3 mm. bore fastened to a vertical centimeter rule The manometer is filled with solution from the reservoir, and the venous pressure reading is made by eliminating the reservoir from the system and allowing the fluid in the manometer to seek a level

Resting erect venous pressure was considered normal if manometer level fell between the projection of the right auricle arbitrarily set at the space between the fourth and fifth costal cartilage

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(2) Surgery 26 435-445 September 1949

and 15 cm. above it. This point was taken as 0 and all changes from it were expressed in centimeters of water as fall or rise.

Three pressures were ordinarily determined resting erect venous pressure, walking erect venous pressure in which the patient walked in place at 120 steps a minute, and walking erect venous pressure during saphenous vein occlusion with the palpating finger The value given is the greatest fall obtained as determined by testing occlusion at various points, usually in the following order internal saphenous vein at the femoral condyle, external saphenous vein below the popliteal space and other points where communicating veins seem clinically incompetent

Average fall of pressure on walking was 52 cm in normal extremities, 27 cm. in varicose extremities and 2 cm. in postphlebitic extremities In varicose extremities, occlusion of the saphenous vein during walking increased the fall in pressure to normal (—57 cm) whereas in normal and postphlebitic extremities pressure fell slightly less well on walking with occlusion than without it

With regard to early results of femoral vein ligation for postphlebitic stasis these tests usually showed little improvement in venous function However, any beneficial effect which the ligation may have could conceivably not be manifest for several months or until collateral circulation has had time to develop

The method is not recommended for routine testing in all clinical cases of varicose veins, it is more adapted to study of limbs in which the competence of the deep system is in doubt

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LYMPHATIC SYSTEM

Spontaneous and Traumatic Lymph Fistulas Data on 40 Cases. Edward S Judd, Jr and James T Nix[3] observed two cases of inguinal lymph fistula following, in one, repair of bilateral femoral hernia and in the other inguinal node dissection in connection with vulvectomy for melanoepithelioma The leakage seemed refractory to treatment

(3) S. Clin. North America 29 1035-1047 August, 1949

and ran its own course for seven weeks and for more than a month, respectively In a review of clinic records from 1908 through 1948 the authors found 40 cases of lymph fistula proved by pathologic examination of the lesion and chemical studies of the fluid exudate These cases seem to justify the following observations.

Incidence of this complication is higher than the small ness of this series would suggest Fistulas of clear peripheral lymph from the cervical axillary and inguinal tracts have seldom been recognized and have frequently passed for serous drainage These fistulas are always annoying and occasionally disabling They may be spontaneous or trau matic in origin.

Spontaneous lymph fistulas (18 cases) are usually associated with advanced lymphatic disease and clinically de monstrable lymph stasis. The lymph exudes from multiple orifices to give a weeping surface Recurrent lymphangitis is often noted. The underlying lymphatic disease tends to spread and spontaneous closure of the fistula is unusual. Surgical measures directed at the underlying lymphatic disorder are occasionally of value (excision and Kondoleon operation)

Traumatic lymph fistulas (22 cases) often follow surgical procedures for relief of stasis However, they also occur after surgical procedures in the vicinity of large lymphatic trunks (neck, axilla and inguinal region) These fistulas are most frequently single and occur in the line of incision, usually at a drainage site They close spontaneously in most instances.

Spontaneous lymph fistulas are usually of longer dura tion (2 months to 25 years in this series) and more refrac tory to treatment than the traumatic type Both types are commonly located below the diaphragm Clear lymph may be identified by a protein content lower than that of serum. In addition, the fat content of chylous lymph exceeds that of blood serum. It seems that prophylaxis is the best treat ment When lymphatic injury is recognized repair or liga tion of the duct and avoidance of drains appears to be the method of choice

Management of Chylothorax is discussed by Richard H. Meade Jr (Grand Rapids Mich) Jerome R. Head (Chi

cago) and Chester W Moen[4] (Boston) In the three cases reported the main etiologic agents were trauma or lymphosarcoma. If chylo leakage is not promptly stopped it causes an inflammatory reaction in the pleura which results in thickening with loss of elasticity and deposition of fibrin exudate on the pleural surface Death from chylothorax, unless the condition is unrecognized and allowed to cause asphyxia, is due to progressive loss of the fluids, protein and fat. A high protein diet, intravenous infusion of amino acids and an occasional blood transfusion should be used to combat depletion. Further experimental work must be done on the cause of reactions after intravenous administration of aspirated chyle before this method can be used for satisfactory treatment.

Study of the thoracic duct arrangement in 135 cadavers showed a single duct in 78 per cent, a short, single duct which divided into two and united either below or above the diaphragm in 17 per cent and a single duct which divided into two and ran through the chest in the remainder

Unless chest exploration must be done for control of an associated lesion immediate ligation of the thoracic duct should not be considered. Chest aspiration should be done at frequent intervals and continued if there is evidence of decrease in chyle leakage If aspiration is unsuccessful closed drainage should be started within 10-14 days. Suction should be applied if fluid is not easily removable, and if this fails to effect re-expansion of the lung and cessation of chyle leakage operation must be done no longer than two weeks after suction drainage is instituted. The duct should be ligated at its lowest possible point and a small segment resected for histologic verification and for determination of any pathologic processes in the duct.

Surgical Manifestations of Sarcoidosis Ronald W Raven[5] states that sarcoidosis is a general systemic disease which expresses itself by various clinical syndromes. It is not as benign as often assumed, since in about half of the reported cases with autopsy data death occurred as a direct consequence of the disorder The disease may involve almost every tissue in the body but has a predilection for the lungs,

(4) J Thoracic Surg 19 709-722 May 1950
(5) Ann Roy Coll. Surgeons England 5 3 28 July 1949

lymph nodes, skin, eyes, spleen, liver and bones. The pathologic lesion is characteristic, and the histologic picture is that of a proliferative rather than of an inflammatory process. There is considerable weight of opinion in favor of the view that sarcoidosis is noncaseating tuberculosis. Females are more often affected than males, and the disease occurs most frequently in the 30-40 age group The disease tends to run a chronic course over three to eight years, and there may be periods of remission The clinical picture is variable owing to certain factors, including site of the disease and degree of progression or regression. As a test for sarcoidosis, Kolm has demonstrated that a suspension of sarcoid tissue sterilized by heat could provoke a slowly forming indolent papule when injected intracutaneously into a patient with the disease Treatment consists of measures to improve general health and increase resistance to the disease Recently, calciferol has been used in doses of 50,000 units twice daily, with improvement in the skin lesions At the Royal Cancer Hospital a number of patients have been successfully treated with radiation. Surgical treatment may be required for relief of mechanical disturbances of the gastrointestinal tract.

Skin manifestations are present in about 50 per cent of cases, may involve the face ears, nose and extremities and may be of papular, nodular, infiltrative and erythrodermic type The lungs are often involved, the lesions being small and distributed symmetrically especially in the middle and lower parts The lymph nodes, particularly the mediastinal group, are involved in most patients

Bone lesions are found in about 20 per cent of patients and tend to be progressive, the hands and feet being usually attacked. The digits are irregularly enlarged, and the tips become squared with some dorsiflexion at the distal interphalangeal joint. In advanced disease, the picture simulates leprosy with painless mutilation of the fingers and gradual disappearance of the terminal phalanges. In some cases the metacarpal and carpal bones especially the scaphoid, have been involved. Roentgen examination shows initially thickening of the trabeculae in the end of a phalanx, followed by development of small punched-out areas forming cystic spaces which vary from pinpoint size to 1 cm. in diameter The trabeculae of the intercystic spaces become

dense and sclerotic In some cases the whole phalanx is involved

Gastrointestinal sarcoidosis is of interest to the surgeon, and, since it is now recognized, more cases will doubtless be reported in the future Only one case has been described, but several cases of small intestine involvement have been reported, among which the two cases of Wangensteen and his co-workers are of great interest. The symptomatology simulated that of regional ileitis in some respects, but some of the characteristics of the latter were absent, including a swelling in the right iliac fossa, local peritonitis or fistula formation. Roentgen appearances were generalized rather than localized, and there were areas suggestive of polyposis, a feature not seen in regional ileitis There has been some controversy over the relationship between these two diseases While there is much evidence against the view that the two are related, this concept cannot be completely discarded until a series of cases of regional ileitis has been observed for 10 years.

Raven has been unable to find a description of a sarcoidosis of the colon in the literature He reports a case in which symptomatology and roentgen appearance favored a diagnosis of carcinoma at operation it was thought that the lesion was a fibrocarcinoma of the colon and radical excision was performed Microscopic examination showed sarcoidosis. In reviewing the case, it was felt that this was the correct procedure for a constricting sarcoid The terminal ileum was normal, a point of distinction from regional ileitis.

Splenomegaly is commonly present in sarcoidosis, and enlargement may be considerable When splenomegaly and hepatomegaly coexist, the condition must be differentiated from Banti's syndrome in the literature several cases have been thus diagnosed and splenectomy performed. After operation the true nature of the disease was discovered

Hyperhidrosis Observations in 61 Cases J Ross Veal and John N Shadid[6] (Georgetown Univ) state that in their cases beads of sweat collecting and dripping off the skin were a constant feature, vasoconstriction was almost constantly present, and tachycardia, vasomotor instability, emotional imbalance and inner tenseness were often observed, depending on whether or not the sympathetic stimulus was central or peripheral in origin They consider the term hyperhidrosis incorrect and propose the more de scriptive term hypersympathotonia which implies that through abnormal stimulation normal sympathetic responses are exaggerated to the point of being pathologic

Cases may be divided into primary and secondary The primary form usually manifests itself early in life and may be congenital or acquired it is often familial, and females are affected more than males In the secondary form, usu ally only part of the sympathetic system is involved and the exciting cause is injury or inflammatory process in volving some part of the peripheral nervous or vascular system. The traumatic nerve injuries are seldom severe enough to cause paralysis The essential differences between the symptoms of the primary and secondary types are mainly in extent of involvement In neither group have the sympathetic ganglions been found organically diseased

Many persons with mild hypersympathotonia do not re quire treatment. Some may have exacerbations during periods of intense stress and strain which usually subside when equanimity is restored. However certain persons have severe and persistent symptoms that become a real handi cap Excessive sweating of the hands may become a social and occupational hindrance Vasospasm may be such that symptoms of impaired circulation are disturbing Fatigue of the lower extremities is common. Several patients had intermittent claudication, and several, venous thrombosis from persistent vasospasm These severer forms should have the benefit of sympathectomy

(6) Surgery 26 80-95, July 1949

In this series, 23 patients underwent surgery for a total of 72 operations Preganglionic cervicodorsal sympathectomy was used for the upper extremities, and the second to fourth lumbar ganglions were resected for the lower extremities Results were uniformly good and there has been no recurrence of sweating The sweat glands, however, retain their ability to function. Vasospastic symptoms were relieved in all but three patients, fatigue, night cramps and

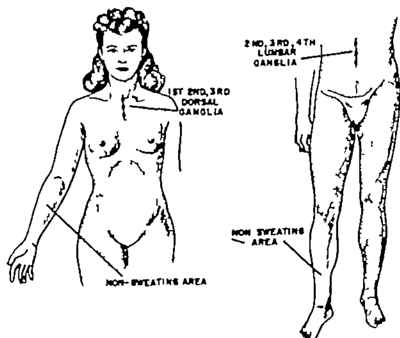


Fig. 85 (left).—Area controlled by first to third dorsal ganglions is nonsweating after cervicodorsal sympathectomy Dots represent sweating area, which may function excessively under proper stimulation.
Fig 86 (right).—Area controlled by second to fourth lumbar ganglions is nonsweating after lumbar sympathectomy
(Courtesy of Veal, J R and Shadid, J N Surgery 26 89 98 July 1949)

intermittent claudication were relieved. The dry areas following cervicodorsal and lumbar sympathectomy are shown in Figures 85 and 86 That portion of the body in which the nerve supply to the sweat glands remains intact then responds to certain forms of sympathetic stimulation by excessive sweating

Scleroderma Diffusa. E Gohrbandt[7] (Berlin) states that this chronic disease rarely yields to treatment and after years of misery leads to death The predominant lesion—

(7) Zentralbl. f. Chir 73 581 587 1948

of the skin—is only one manifestation of underlying disease of all connective tissues of the body The skin becomes leathery, inelastic, pigmented and finally atrophic. Similar conditions prevail in the subcutaneous tissues, muscles, bones, spleen, liver and vascular system

Prodromal symptoms are intermittent fever, vasomotor disturbances and changes in the vegetative nervous system, which may be present years before the skin changes appear Once established, the disease runs through three overlapping stages edematous, indurative and atrophic

Of many theories of etiology, four seem most acceptable (1) vascular, (2) infection of the nervous system, (3) thyroid, and (4) infection. It is generally believed that the most serious changes lie in the blood vessels Under the microscope otherwise normal capillaries show a spastic condition, and there is dilatation of venous capillaries. These changes are similar to those in Raynaud's disease, and the two conditions are easily confused. Circulatory disturbances exist, but whether they are primary or secondary cannot be determined. They may result from changes in vessel walls due to repeated spasm, disease of the vegetative nervous system or a primary lesion of the terminal reticulum.

In peripheral circulation the vegetative nervous system plays a major role Stimuli and injuries from the terminal reticulum are transmitted by the nervous system which for a time can carry the load without special structural changes but eventually shows the effect of overloading by changes in the sympathetic nerves and especially the ganglions. To fit this theory with the other three is not difficult. Infection involving the nervous system affects the entire organism. The thyroid in hyperthyroidism calls forth disorders in the nervous system and it and the adrenals regulate sympathetic nerve activity

Gohrbandt justifies blocking of the sympathetic nerve on this premise The history of a patient with scleroderma diffusa is reported which is typical except for sudden onset. Two intravenous injections of procaine failed to benefit the patient, but blocking of the stellate ganglion with 10-15 cm. of a 1 per cent solution brought immediate improvement in neck, arms, head and legs. A second injection of the stellate ganglion gave complete relief of sympt—

Of 10 other patients given similar treatment, 2 are cured and 6 improved, treatment of the last is not completed.

Procaine is used with or without additional epinephrine. The first injection is on the side of the more serious skin lesions. Patients report that this first injection is followed by pronounced general improvement. Total blocking of the stellate ganglion has not seemed justified. The earlier treatment is begun, the better will be the results.

[The author probably did not know of cortisone or it was not available to him at the time of writing.—Ed.]

Patterns of Electrical Skin Resistance Following Sympathectomy were charted by Jesse E. Thompson, Nicholas A. Brose and Reginald H. Smithwick[8] (Boston Univ.) on 177 patients having sympathectomy on 377 sides or extremities.

METHOD.—All tests were carried out with the Richter neurodermometer. Essentially the machine consists of a microammeter, a 4½ volt battery, a 1,000 ohm potential divider and two electrodes. The machine indicates differences in skin resistance as the electrode is moved about. Readings were divided into three groups: normal sweating, or low resistance; slight sweating or moderate resistance, and no sweating, or high resistance.

The patient is placed in a hot room under blankets for 20 minutes or until he begins to sweat. Hot tea or acetylsalicylic acid may be administered. The ear electrode is covered with electrode paste and clipped to one ear lobe where a slight needle puncture wound of the lobe is made to eliminate local resistance. The electrodes are connected to the neurodermometer; the movable electrode is placed lightly against the skin and the current is adjusted until the indicator moves entirely across the scale in nondenervated or sweating areas. When so set the indicator does not move or moves only a few divisions on the scale in completely sympathectomized or high resistance areas. "Scout" readings of the entire body or extremity are quickly taken to indicate the approximate lines of demarcation of differences in skin resistance. Areas of high and low resistance are carefully mapped by moving the electrode back and forth. Unless the electrode is moisture free when moved to one area from another the reading will be inaccurate. The line of demarcation is marked with a skin pencil until the entire area is tested and the areas so mapped are charted. Lines of demarcation are sharp, usually being within a strip 5 mm. wide.

After removal of the second and third dorsal nerves, in the usual dorsal sympathectomy, the face, arms, hands and upper part of the thorax are generally completely anhidrotic and Horner's syndrome is not present. Some areas on the

(8) Arch. Surg. 60: 421-451, March, 1950.

face arms and axillae may occasionally continue to sweat indicating incomplete denervation Preganglionic sudomotor outflow to the head and arms usually arises below the first dorsal division and the principal outflow to the pupil is usually from above the second dorsal division Removal of the first dorsal ganglion generally results in Horner's syndrome

Scattered areas on the chest wall and axilla may sweat after extensive thoracic or near total sympathectomy The lower dorsal ganglions contribute an insignificant sudomotor outflow to the lower extremities, the major contributions coming from the first and second ganglions The interior part of the thigh receives innervation from the first lumbar ganglion mainly and some from the second and perhaps the third The lower part of the leg foot and posterior region of the thigh are almost completely anhidrotic when the upper lumbar ganglions are resected. Removal of eighth dorsal through third lumbar ganglions occasionally completely denervates the entire lower extremity, but in most cases the anterior part of the thigh continues to sweat even after near total sympathectomy It has been shown that this area can be made anhidrotic by section of anterior roots of the lumbar nerves especially the first. Sympathetic pathways lying entirely outside the ganglionated sympathetic trunks probably account for the areas of residual sweating after conventional sympathectomies.

Diffuse outflow and similarity of pattern after different combinations of ganglionectomy sometimes make it impossible to tell from the postoperative pattern of skin resistance the exact extent of sympathectomy performed

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ESOPHAGUS

Esophageal Arteries Their Configurational Anatomy and Variations in Relation to Surgery are described by Alfred L. Shapiro and Gregory L. Robillard[9] (Brooklyn) who have made anatomic studies on 50 bodies The cervical portion

(9) Ann. Surg. 131 171 185 February 1950

of the esophagus (Fig 87) receives its primary blood supply from the inferior thyroid artery, a branch of the thyrocervical trunk of the subclavian artery The major artery sometimes arises from the thyroid ima or common carotid artery Collaterals may connect with the superior thyroid, bronchial arteries or aorta Accessory arteries may arise from the subclavian carotid or vertebral arteries or aorta.

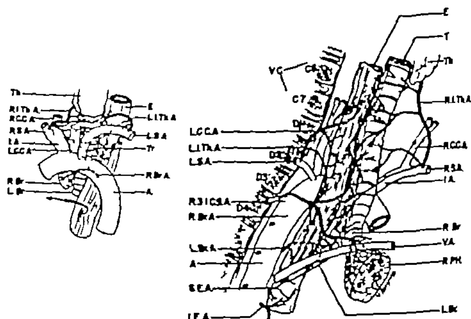


Fig 87 (left) —Pars cervicalis, typical pattern right inferior thyroid supplies more branches than left. Posterior esophageal twigs, relatively few and small; many tracheal and esophageal twigs arise as bifurcations from common tracheoesophageal artery lying in groove. Anastomosis with ascending branch of right brachial artery is usual.

Fig. 88 (right) —Pars bifurcalis, usual pattern: right bronchial artery, often originating from right third intercostal artery passes behind esophagus. Vertical tracheoesophageal artery in tracheoesophageal groove is formed by anastomosis between descending branches of right inferior thyroid artery and ascending branches of right bronchial right bronchial also anastomoses, in this specimen with superior esophageal artery

(Courtesy of Shapiro, A. L., and Robillard, G L. Ann. Surg. 131 171 188 February 1950)

The portion of the esophagus adjacent to the aortic arch and tracheal bifurcation (Fig 88) receives its primary blood supply from the bronchial arteries which may originate from the aorta or the right third or fourth intercostal arteries. There may be collateral circulation with the inferior thyroid, subclavian carotid, third intercostal or thoracic esophageal arteries as well as the aorta. Accessory arteries

may arise from the aorta, innominate, subclavian, carotid, upper intercostal or internal mammary vessels.

The thoracic portion of the esophagus receives its primary supply from the superior and inferior esophageal arteries which arise from the thoracic aorta. Anastomoses may occur with the left or right bronchial, inferior phrenic or left gastric arteries. Accessory arteries may arise from the lower intercostal arteries, the celiac axis or aorta.

The primary supply of the abdominal portion of the esophagus (Fig 89) is via the left gastric artery, which arises from the celiac trunk. Other major arteries to this

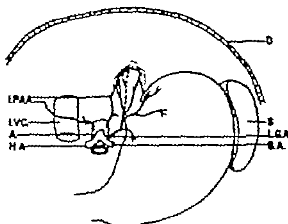


Fig. 89 —Pars abdominalis, typical pattern cardiotuberous branch of left gastric artery provides several branches to infradiaphragmatic segment of esophagus. Posterior ascending twig is seen, entering into anastomosis with inferior thoracic esophageal artery (Courtesy of Shapiro, A. L. and Robillard G. L. Am. Surg. 131:171 185 February 1950)

portion may arise from the inferior phrenic, gastrohepatic or splenic arteries, the aorta or celiac axis. Anastomoses in the arterial supply for the abdominal portion show numerous variations.

Embryologically the trachea, bronchi, lungs, thyroid, esophagus and diaphragm have intimate relationships which may account for the intermingling of their blood vessels. Extensive separation of the upper esophagus and trachea results in laceration of many vessels and a meager collateral supply This may account for the sloughing of exteriorized cervical esophagus and failure of many attempted anastomoses with skin tubes Extensive mobilization at the pars bifurcalis may lacerate much of the vascular supply Since

about half the cases in this series showed no appreciable compensatory collateral circulation complications such as late stricture formation, recurrent obstruction or gradual necrosis may be attributed to this devascularization. The thoracic portion may be gently separated from the aorta for several centimeters without marked devascularization but the two esophageal arteriae propriae should be preserved unless resection is intended Collateral circulation from above is fairly adequate for short portions left for anastomosis. If the left gastric artery is severed to facilitate gastric mobilization and the complete length of the thoracic esophagus is extensively freed, the lower esophagus may be seriously devascularized. In low esophagogastrostomy for cardiospasm or stricture, ligation of the left gastric artery is inadvisable In total gastrectomy, if the hiatus is opened widely and the esophagus dissected free without regard for the regional supplying arterial twigs, the lowermost segment of esophagus will have an impaired blood supply and should be resected rather than utilized for anastomosis.

Role of Esophageal Motility in Surgical Treatment of Megaesophagus has been studied by I. Darin Puppel[1] (Ohio State Univ) Kymographic tracings were made of esophageal motility using intraesophageal balloons attached to Einhorn tubes Observations in three normal persons disclosed that the character of the intrinsic motility varied greatly not only from person to person at the same level of the esophagus but at various levels and at various times at the same level in the same person. Changes in character of breathing produced no appreciable change in the tracing The balloon could be distended with but 20-40 cc. of air without producing pain, the amount depending on the balloon's location and the type of person. There was almost a persistent intrinsic esophageal motility when a nonpain producing inflated balloon was held in place by adequate anchorage of the tube The motility was active responsive to stimulation, well co-ordinated and effective producing powerful peristaltic waves Deglutition effect was excellent even when the subject was placed in the Trendelenburg position. The number of contractions varied from one every three minutes over a short duration to seven every minute

(1) J Thoracic Surg 19 371 390 March 1950

over long periods of time Administration of atropine sulfate subcutaneously resulted in a great decrease in number and height of contractions whereas urecholine* produced the opposite effect.

Movements of the esophagus were studied in a patient whose cardia function had been abolished by resection of the esophagogastric junction. When the patient was placed in Trendelenburg position after barium swallow the backward rush of barium from the stomach into the esophagus was suddenly stopped by the cricopharyngeus sphincter The peristalsis of the esophagus was manifest by a wave of contraction passing along the esophagus at a fairly rapid speed which propelled the heavy barium contents uphill before it for 5-6 cm. from the cricopharyngeus and at times for the whole length of the esophagus As the contractions proceeded the esophagus was completely emptied of barium

Similar studies were carried out on two patients with megaesophagus which did not respond to conservative treatment and in whom a type of esophagogastrostomy similar to Finney's pyloroplasty had been performed The clinical result was good in both patients In one patient, 2½ years after operation, peristaltic deglutition was so active co-ordinated and responsive to stimulation that it was difficult to obtain a good x ray of the esophagus during barium swallow The esophagus had gradually returned to a normal size Because of rapid emptying of the esophagus he was able to eat rapidly without symptoms. During motility studies substernal pain resulted when the balloon was inflated with 20 cc. air There were almost continuous periods of irregular contractions of variable low amplitude and infrequent occurrence The character of breathing played a definite part in character of tracings Administration of atropine abolished intrinsic activity to as great an extent as in the normal and urecholine* caused vigorous contractions and pain which necessitated release of air from the balloon. With the patient in Trendelenburg position following barium swallow the barium rushed rapidly against the cricopharyngeus sphincter but the wave of contraction was weak and usually produced a feeble undulation of the esophagus. Barium contents were never propelled

uphill for over 2-3 cm., and this occurred only when attempts were made to swallow voluntarily Barium contents were never detectably emptied into the stomach.

In the second patient fluoroscopic studies showed that the megaesophagus was atonic and unable to evacuate its contents properly so that 2½ years postoperatively x rays still showed an 18 cm. esophageal fluid level. The esophagus was hugely dilated and did not appear to have been reduced appreciably in size The esophageal contents slowly emptied into the stomach and only by eating slowly could the patient remain symptom free Complete absence of motor function of the esophagus was demonstrated, and influence of respiration on esophageal movements was outstanding When the patient was placed in Trendelenburg position following barium swallow the barium collected against the cricopharyngeal sphincter and lay like water in a stagnant pool. Stretching by an inflated balloon caused definite pain, suggesting that sympathetic innervation remained intact. These data contradict the earlier opinion that pain in achalasia is conveyed by vagal afferent fibers.

Observations in these patients suggest that achalasia is not necessarily localized to the cardiac end of the esophagus, but that functional abnormalities may often involve the whole length of the esophagus.

Concerning Unfavorable Late Results of Certain Operations Performed in Treatment of Cardiospasm. N R Barrett and R. H. Franklin[2] (London) state that 19 of 25 patients had esophagogastrostomy in which the fundus of the stomach was brought up through the diaphragm and anastomosed to the side of the esophagus about 1½ in. above the cardia and 6 had cardioplasty by dividing the esophagogastric junction in a longitudinal direction through all coats and suturing the incision transversely Heller's operation was not done this is a sound procedure, whereas the two operations described are unsound The authors believe that the late harmful effects of anastomotic operations done to relieve achalasia are not due to the way the anastomoses have been performed but to the fact that an abnormal communication has been created between stomach and esophagus

(2) Brit J Surg. 37 194 202 October 1949

The immediate relief afforded by these operations is striking but usually does not last more than three to six months. Of the 19 patients who had esophagogastrostomy, 3 were clinically well at the time of the report but 16 have trivial to serious defects. Of the six cardioplasty patients, three were symptomatically cured but four had evidence of esophagitis and only one had no signs or symptoms on careful investigation. The causes of failure in both operations are similar. A new type of dysphagia develops in some patients, most striking after esophagogastrostomy, which is partly due to kinking at the anastomosis and partly to contraction of the stoma. The dysphagia is never so bad as before operation and the patients generally manage to overcome it by various means. However, the serious problem is the almost constant development of esophagitis, of which four types have been observed (1) inflammation due to regurgitation of gastric contents into the lower esophagus (2) peptic ulceration of the esophagus occurring in an islet of ectopic gastric mucosa (3) what can be called acute ulceration (4) what is best described as retention ulceration.

The cause of esophagitis is incompetence of the cardia, induced by short circuiting the cardia by cardioplasty or by any operation that leaves the esophagogastric junction above the diaphragm. This sets the stage for regurgitation with exposure of the susceptible esophageal mucosa to the digestive effects of gastric juice. The characteristic esophagoscopic appearance is hyperemia of the mucosa, which tends to bleed easily and to form superficial, angry looking ulcers. The latter may heal and break down again. If healing has occurred patches of leukoplakia may be seen. The condition has a definite tendency to relapse and, after repeated attacks, may lead to involvement of the muscularis and formation of organic stenosis, periesophageal adhesions and inflammatory adenitis. Healing may thus result in shortening of the esophagus and stricture formation.

The outstanding abnormalities in these patients were bleeding and pain; dysphagia was sometimes present also. They varied in severity from patient to patient and in the same person from time to time. These variations may account for the fact that the lesions have not been reported

levels Diagnosis is certain if a swallow of lipiodol* extravasates into the mediastinal or pleural cavity

Mistaken diagnoses usually made in these cases include coronary occlusion, pulmonary embolus, dissecting aneurysm, perforated ulcer of the stomach or duodenum, acute pancreatitis and renal colic Too frequently a diagnosis of intraperitoneal surgical accident is made and laparotomy performed

Once the diagnosis of spontaneous esophageal rupture is made, treatment is surgical Despite shock, operation must be performed early combined with supportive measures. Conservative treatment has resulted in a 100 per cent mortality Preferable surgical treatment is local repair of the rupture by three layer closure, but if necessary resection of the esophagus may be performed

Four Cases of Supra aortic Esogastric Anastomosis for High Cicatricial Stenosis of Esophagus are reported by P Santy and P Maillet [5] The four patients in whom left transpleural supra aortic anastomosis was done successfully, included three with juxta aortic stenoses of 2, 3 and 14 years' duration (two children aged 6 and a youth aged 17) and one with supra aortic stenosis (man aged 33) Five characteristics which were common to the four cases are given.

1 The stenosis most often began at the level of the aortic arch, probably owing to the fact that the aortic impression forces a slowing down of the fluids propelled by the pharyngeal contraction.

2 The stenosis extended from the aortic arch to the cardia At operation the mediastinum was found to be transformed into a rigid, immobile block traversed by dilated vessels. Dissection of the stenosed segment was evidently impossible Only anastomosis could be considered.

3 In one patient it was easy to establish a cleavage plane for the esophagus above the stricture and the wall was healthy, however, in the other three there was a more or less dense periesophagitis which impeded access to the tube and exposed the left recurrent nerve and thoracic duct (which had to be ligated twice) to injury The esopha

(5) Lyon chir 45 161 16 Feb. Mar., 1950

geal wall was thin and friable and did not show the usual separation of mucosal and muscular layers

4 The postoperative course was simple and short the children having withstood without shock combined interventions lasting four to five hours

5 Postoperatively, the four patients were able to swallow even solid food without pharyngeal effort regurgitation or bad breath There was no postprandial intrathoracic discomfort nor abdominal disturbance The gastric pouch, flattened in the costovertebral sinus did not prevent expansion of the lung and respiratory capacity was only slightly decreased

The authors consider left transpleural supra aortic anastomosis the method of choice for all esophageal stenoses which are impassable or in which results of dilatation cannot be maintained, provided the stenoses do not overlap the upper border of the aortic arch

Predysphagic Gastric Syndrome in Esophageal Cancer

Ignazio Scalone[6] (Milan) observed this syndrome in 11 men and 3 women in 10 the cancer was in the subcardial or cardial portion of the esophagus The syndrome is of two types In 10 patients it was of gastric ulcer type with gastric pain one to three hours after meals sometimes so severe as to cause vomiting hyperchlorhydria, pyrosis and hyperkinesia of the gastric wall Improvement will follow use of alkaline drugs and belladonna The other four patients had anorexia slow digestion asthenia, hypoacidity and hypokinesia of the gastric wall Duration of symptoms before dysphagia was manifest was 3 years in one patient, 1½ years in three 1 year in three and 8-10 months in the others gastric resection for ulcer had been done in one patient six years previously Roentgen examination showed no organic lesions in the stomach of any patient

Scalone believes that the gastric syndrome is due to neoplastic infiltration of the two vagus nerves These nerves separate above or at the level of the sixth rib and form a true plexus close to the wall then unite in the cardial portion to re form the two nerves This plexiform arrangement favors neoplastic infiltration, which may also act on the nerves by causing disturbances of circulation in the nerve

(6) Presse méd. 58 199-200 Feb 25 1950

fibers Since section of these nerves in gastroduodenal ulcer causes arrest of pain, permanent or temporary hypochlorhydria, hypotony of the gastric wall, etc, the syndrome found in most patients must be due to excitation of the vagus nerves

The gastric syndrome caused by infiltration of the vagi without any signs of change in the stomach should raise suspicion of cirrhotic cancer of the lower portion of the esophagus, which should then be investigated without waiting for the appearance of dysphagia In time esophagoscopy will reveal disturbances of the local circulation, fixity rigidity and any other modification in the wall of the organ.

Treatment of Malignant Obstruction of Cardia is described by P R. Allison and J Borrie[7] (Gen'l Infirm, Leeds)

METHOD.—The most satisfactory palliative measure is passage of bougies under direct vision until the lumen is wide enough to take a Souttar tube. A fluid and soft solid diet taken through this relieves thirst and starvation and provides mental relief to the patient.

Radical treatment of lesions of the lower end of the esophagus or cardia is based on distribution of the lymphatics of the stomach (Fig 90) through which cancer may spread from these sites. Distant metastases, gross arterial degeneration or poor cardiorespiratory function contraindicate radical operations. Thin patients are usually better risks than fat ones. Because of advanced emaciation some patients may have no resistance to operation or sepsis and sound wound healing will not occur

The patient is usually hospitalized about two weeks before operation for improvement of nutritional status with a high calorie fluid and semisolid diet and extra vitamins. Even if it can be swallowed, solid food is not given in order to reduce stagnation and sepsis. The pharynx is washed after each meal with a drink of water or soda water Teeth are brushed frequently, mouthwashes are given and dental extraction is performed if teeth and gums are beyond other treatment. If much weight has been lost mouth feeding is supplemented by intravenous plasma blood transfusions may be necessary Penicillin therapy is begun the night before operation and continued postoperatively until no longer indicated.

The morning of operation ¼ gr morphine and 1/150 gr scopolamine are given and a blood transfusion started. Enough tubarine® and pentothal® sodium are administered to relax the jaw so that an esophagoscope can be passed. The esophagus is aspirated, cleaned and dried The region immediately above the obstruction is dried with swabs to avoid bleeding from trauma. As the esophagoscope is withdrawn a Tampax pack is inserted just below the cricoid. The nasopharynx is cleaned out through a rubber catheter passed through

(7) Brit. J Surg 37 1 1 July 1949

the nostrils. A pharyngeal airway is introduced and a light pack inserted around it to prevent inhalation of secretions. The patient is then turned on the right side and fixed in position for operation with a pillow under the waist. Good surgical risks are given a spinal anesthetic of light procaine, but if the general condition is less favorable blocking the lowest left eight intercostal nerves with local anesthetic is substituted. The latissimus dorsi is also infiltrated with local anesthetic at the level of the ninth rib. The left splanchnic

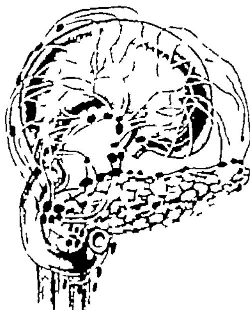


Fig 90.—Lymphatics of stomach as seen when stomach is rotated upward to expose posterior surface. (Courtesy of Allison, P. R., and Borrie, J.: Brit. J. Surg 37:1 21 July 1949; from Jamieson, J. K., and Dobson, J. F. Lancet 1 1061 1907.)

nerves, solar plexus, vagi and left phrenic nerve are anesthetized under direct vision as soon as the chest is opened. The infiltration solution is composed of 0.25 per cent procaine, 0.89 per cent NaCl and 0.05 per cent amethocaine hydrochloride to which 10 minims of 0.001 per cent adrenalin* to 250 cc. of solution is added immediately before use. The first part of the operation is completed with oxygen only being inhaled, in later stages cyclopropane may be used if the patient is restless. During much of the surgical manipulations both lungs are kept normally inflated. If it is necessary to collapse a lung it should be inflated at least every 20 minutes, but gently and slowly to avoid rupture of alveolar walls. At completion of the operation inflation of the lungs is carried out with the chest still open and maintained until the chest is airtight except for sealed under water drain. After the pack is removed from the pharynx and the nasopharynx again aspirated through a soft rubber catheter, the patient may be turned on his back. The Tampax is removed, the

esophagoscope passed and any fluid or blood clot aspirated from the gullet. The chest is viewed with x rays to ascertain that both lungs are fully expanded before the patient leaves the operating room. *Continuous oxygen is given by nasal catheter after his return to the* ward and blood transfusion is continued slowly The underwater drain is removed after about 24 hours. Sedatives are withheld as long as possible, but at night on the day of operation ¼ gr morphine may be given.

The operation is performed through a full thoracoabdominal incision which starts from the middle of the left rectus abdominis muscle and sweeps back to cross the costal margin at the tip of the ninth

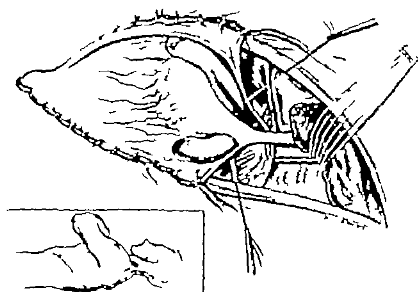


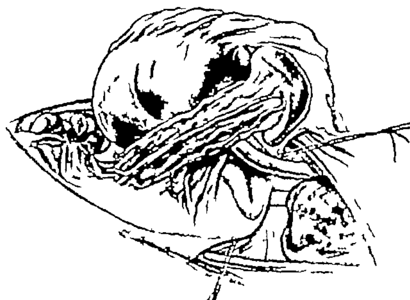
Fig. 91—Left thoracoabdominal incision with resection of ninth rib and cartilage Diaphragm has been split back into hiatus and cut edges have been temporarily sutured to muscles of chest wall for fixation. (Courtesy of Allison, P R., and Borrie, J: Brit. J Surg. 37:1 21 July 1949)

costal cartilage, from here it follows the ninth rib back to the outer border of the erector spinae muscle, where it curves up for 2 in (Fig 91) The posterior end of the eighth rib and all of the ninth rib are removed Pleura and peritoneum are opened, and the diaphragm is split back toward the hiatus from the anterior end of the pleural incision. As the vessels in the diaphragm are caught they are stitched and the anterior stitches sewed to the external oblique muscle on the edges of the incision posterior ones are left long and anchored to the surface by artery forceps. When this incision has been completed there is no need for retractors for the edges fall apart, leaving ample room to do both abdominal and thoracic dissections. Mediastinal pleura is incised at the level at which the esophagus is to be divided. The vagus nerves are cut, and the esopha

gus is drawn out from its bed A thin anastomosis clamp is applied to the esophagus just below the point chosen for resection and firmly closed. The level should be at least 2 in above the top of the growth.

For total gastrectomy, the intestinal loop should be prepared first for division of the vessels in the mesentery by Roux's method is tedious and better done before the surgeon is tired. Intestinal continuity is restored by end to-side anastomosis at the base of the loop and the cut edge of the mesentery of the upper jejunal segment is stitched to the right side of the mesentery of the loop to prevent internal hernia. Anastomosis is performed without clamps to avoid damage to the veins of the mesentery If the free edge of the mesentery of the loop lies across the duodenojejunal flexure, the peritoneum around the latter is divided and the flexure displaced. The spleen is drawn forward, the outer layer of the lienorenal ligament divided and the incision carried up over the diaphragm nearly to the hiatus. Traction on the spleen and sharp and blunt dissection displaces the whole stomach bed forward. The left crus of the diaphragm where it fans out is cleaned and divided into the hiatus after ligature and division of the inferior phrenic vessels. The suspentaculum lienis is divided and the lesser sac opened below the spleen The great omentum is drawn up and separated from the transverse colon as far as the first part of the duodenum. As the pancreas is drawn forward the peritoneal reflection from the lower border is divided until the inferior mesenteric vein is reached (Fig 92) The fold of peritoneum between pyloric antrum and pancreas is divided and the duodenum freed as far as the pancreatoduodenal vessels on its posterior surface. The right gastroepiploic vessels are divided at their junction with the parent vessels. The upper border of the pylorus and adjacent part of the duodenum are freed by division of pyloric vessels and a crushing clamp is applied across the duodenum. With the mass of tissue still displaced forward, the splenic vein is isolated where the inferior mesenteric vein joins it and is divided so as to leave the tributary from the large intestine intact. The splenic artery is ligated and divided where it arises from the celiac axis. At this stage it may be necessary to divide the left gastric vein where it crosses to join either the splenic or the portal vein. The pancreas is divided with the diathermy knife and a few bleeding vessels in this substance are secured with a running stitch. The left gastric artery is cleaned and divided at its origin, and the surrounding lymphatic and nerve tissue, which often contains small veins, is ligated and divided. The mass of tissue is now drawn back and the lesser omentum divided from the top of the duodenum along the hepatic artery and portal vein to the hilus of the liver along its attachment to the liver where a few small vessels should be ligated. This brings the dissection to the right side of the hiatus of the diaphragm. The peritoneum here is incised, and the right inferior phrenic vessels and fibers of the right crus are divided Cellular tissue immediately above the hiatus is drawn away from the diaphragm, pericardium and right pleura and dissection carried up into the medi

astinum as far as the clamp on the esophagus. A second clamp is placed across the pylorus, and the duodenum is divided and sutured with infolding A second clamp is applied to the esophagus above the first and the esophagus divided The mass of tissue is removed.



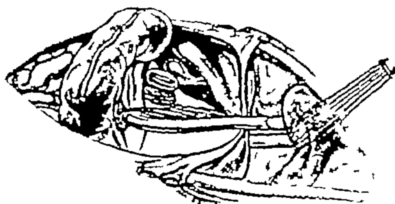


Fig 92 (top) —Stomach and great omentum spleen and pancreas drawn forward, and peritoneum from lower border of pancreas divided as far as inferior mesenteric vein.

Fig 93 (bottom) —Jejunal loop threaded through transverse mesocolon and passing up into mediastinum to cut esophagus.

(Courtesy of Allison P R., and Borrie J Brit. J Surg. 37 1 21 July 1949)

The jejunal loop is threaded through a hole in the transverse mesocolon and laid in the mediastinum to make sure that it reaches the esophagus without tension (Fig 93) After the anastomosis site is noted, the intestinal loop is drawn from the chest and an incision made along the line of anastomosis through the peritoneal and mus-

cular coat down to the submucosa. The loop is replaced in the mediastinum and a row of interrupted catgut sutures inserted through its peritoneomuscular wall above the incision and the fibromuscular wall of the esophagus. The lumen is opened and a single holding suture passed through the middle of the anterior wall of the esophagus to include the muscle and mucosa and maintain them in contact. This stitch is left long and a clip attached to it outside the wound. A continuous catgut stitch is inserted through the full thickness of jejunum and esophagus to unite their posterior walls. The stitch starts at the far end of the anastomosis and is taken around the near end to the middle of the anterior walls where it is left long and clipped. A second continuous stitch starts at the same place as the first, to which it is tied, and passes along the anterior wall toward the midline. It is tied to the first one in the middle of the anterior walls. The clamp is released from the esophagus so that the anterior and posterior walls separate. Traction on the "holding stitch" in the esophagus keeps the mucosa of the esophagus from slipping upward and escaping from the continuous stitch as the anastomosis is completed. A single row of interrupted catgut stitches is placed anteriorly through the fibromuscular and peritoneomuscular walls to sink the line of junction of mucosa. This completes the anastomosis and the loop is loosely sutured to the mediastinal pleura and the edge of the diaphragm by a few interrupted stitches. The diaphragm is closed around the loop and its mesentery; a little penicillin and sulfonamide powder dusted into the subphrenic spaces and mediastinum and the chest closed in layers with an underwater drain in the pleura.

Total gastrectomy is done for lesions of the cardia; partial stomach resection may be performed for lesions of the lower end of the esophagus. The aim should be to remove the cardia, fundus and practically the whole of the lesser curvature, leaving the greater curvature and adjacent part of the body of the stomach to form a tube which can be anastomosed to the esophagus. The spleen, pancreas and retroperitoneal tissues are displaced forward as described. Only the left half of the great omentum is removed with the fundus. The dissection along the greater curvature of the stomach is carried to where four or five branches of the right gastroepiploic vessels are left intact. The pancreas and splenic vessels are divided as described. The pyloric vessels are not divided, but a point is chosen on the lesser curvature of the stomach where they anastomose with the left gastric vessels. The lesser omentum is divided here and the adjacent part of the curvature cleared of vessels. Clamps are applied obliquely from this position across the stomach to the point on the greater curvature which has been cleared of greater omentum. The stomach is divided and closed and the mass of tissue containing the growth removed. Since this operation is done for esophageal carcinoma, resection of the esophagus is correspondingly higher than when total gastrectomy is done. The remaining part of the stomach is swung up into the mediastinum and anastomosed to the cut end of the esophagus in the same way as described for the jejunum

The patient is given sips of fluid immediately after operation by the fifth day he may be taking soft solids, and by the tenth he should be taking a normal diet. Early ambulation is encouraged, and chest and leg exercises are carried out. The patient should sleep propped up in bed to avoid inhalation of intestinal contents during sleep Complications such as mediastinal or peritoneal sepsis, bronchitis, bronchopneumonia, cardiac or peripheral vascular failure, intestinal ileus or suture line leakage should be kept in mind.

Of 49 patients in whom partial esophagogastrectomy was performed, 26 died of the effects of operation. The others survived but in only 13 was convalescence completely uncomplicated Of patients subjected to total gastrectomy, 7 died of operation and 3 of metastases, 14 are living 2 25 months postoperatively

Cervical Esophagogastric Anastomosis Following Subtotal Resection of Esophagus for Carcinoma was performed

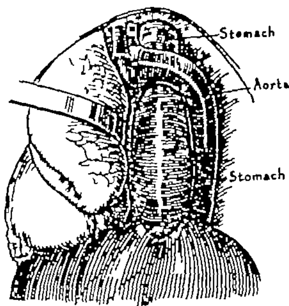


Fig 94 —Position of stomach in thorax. Aorta has been mobilized by division of upper three intercostal arteries. (Courtesy of Wylie, R. H., and Frazell, E. L Ann. Surg 130 1 8 July 1949)

by Robert H Wylie and Edgar L Frazell[8] (Columbia Univ) in a man, 68 who showed no evidence of spread of the tumor located at the junction of the thoracic and cervical esophagus

(8) Ann. Surg. 130-1 8 July 1949

Technic.—The chest was entered through a posterolateral incision over the left seventh rib, which was removed subperiosteally. Esophagus and aortic arch were mobilized; stomach and duodenum were freed so that the stomach could be brought well up into the chest and the pylorus up to the diaphragm without tension; the stomach was incised distally to the cardia and closed; the distal end of the esophagus was closed; a Witzel type jejunostomy was performed

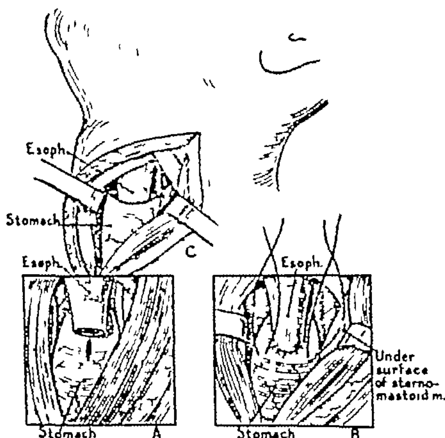


Fig. 93.—Esophagogastric anastomosis in neck. *A*, fixation of apex of stomach to prevertebral fascia and row of sutures between posterior wall of esophagus and stomach. *B*, supporting sutures placed after anastomosis. *C*, completed anastomosis. (Courtesy of Wylie, R. H., and Frazell, E. L.: Ann. Surg. 130:1-6, July 1949.)

about 20 cm. from the ligament of Treitz and the esophagus was drawn above the aortic arch. The left arm was raised and suspended to allow access to the neck, and an incision was made along the anterior border of the sternocleidomastoid muscle, which was retracted laterally. The left lobe of the thyroid was enlarged and nodular and was resected. By incising medial to the carotid sheath and inferiorly, the dissection plane of the esophagus was entered. The esophagus was drawn up into the wound and mobilized to the level of the thyroid cartilage. The stomach was brought up beneath and to the right

of the aorta and passed up into the neck through the aperture once occupied by the esophagus, and thus lay in the normal position of the esophagus (Fig 94) The apex of the stomach, a point on the greater curvature above the gastrolienal ligament, was fixed to the prevertebral fascia by interrupted 0000 silk. A row of interrupted mattress sutures was placed between the anterior wall of the stomach and the posterior wall of the esophagus. A vertical incision 3 cm. long was made in the stomach, and the esophagus was cut through leaving the proximal cut surface for anastomosis. Through-and through interrupted 0000 silk sutures were used for the anastomosis, but before closure a Levin tube was passed into the stomach. A supporting row of serosal sutures was placed anteriorly The anterior surface of the stomach below the anastomosis was drawn cephalad and sutured above the anastomosis to the fascia on the thyroid cartilage and the undersurface of the sternocleidomastoid muscle. The cervical wound was closed in layers around a small Penrose drain (Fig 95) The stomach in the chest was fixed by interrupted sutures to the aperture at the base of the neck and to contiguous mediastinum down to the diaphragm, which was closed about the prepyloric area with interrupted silk. Through the eighth interspace in the axillary line a large fenestrated drainage tube was introduced into the chest, which was then closed in layers. The patient was well 14 months after operation.

Performance of jejunostomy at time of operation is probably superfluous when it has been unnecessary as a preoperative means of improving nutrition However, it provided a good means of maintaining nutrition postoperatively during the six days before it was deemed wise to allow food by mouth.

Control of Esophageal Hemorrhage by Pneumatic Tamponade and Thrombin in two cases is reported by Bruce Kenamore and Gladden Elliott[9] (St. Louis)

APPARATUS.—The apparatus (Fig 96) is adapted from a Miller Abbott tube cut to a length of 60 cm. Near the distal end a latex balloon, 15 cm. long is secured about the tube so that the openings of one lumen will permit inflation. Beyond the balloon the tube extends for 15 cm. and contains openings from the opposing lumen. This allows aspiration of and injection into the stomach when the tamponade is distended in the esophagus where it compresses the varices sufficiently to interrupt bleeding Additional coagulation can be induced in the ruptured vessel by local application of a thrombin preparation. The tamponade is inflated and coated with topical thrombin and again collapsed before it is introduced. The apparatus is then inserted to the correct position into the esophagus and the balloon distended with about 180 cc. air After this, the patient is given orally at 30 minute intervals 5 cc. of a 1 10 solution of topi

(9) Gastroenterology 13 73 76 Jul. 1949

cal thrombin for a total of four doses. This solution seeps down around the tamponade and provide additional hemostasis in areas where oozing continues.

In the first patient, a boy aged 15 with massive hematemesis, hourly gastric aspirations through the tube showed that bleeding had apparently stopped four hours after insertion of the pneumatic tamponade. In the second patient,

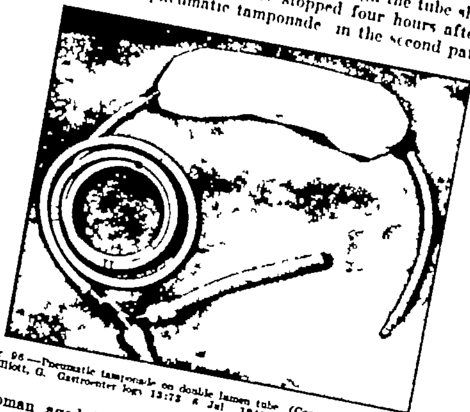


Fig. 96.—Pneumatic tamponade on double lumen tube. (Courtesy of Kenamore, B. and Elliott, G.: Gastroenterology 13:73, 6 Jul. 1949.)

a woman aged 73 with massive hematemesis for several days, there was no further bleeding after introduction of the tamponade.

Method for Control of Bleeding from Esophageal Varices. Thomas B. Patton and Charles G. Johnston[1] (Detroit) used a plastic tube with four lumens. A Rehfuss tip sufficiently small to pass through the nares is incorporated into the end of the largest lumen of about 4 ft. of tubing. 8 in. above this a balloon of rubber the consistency of glove rubber is tied on, and immediately above this an additional balloon made of an entire condom is applied. The two balloons are separately inflatable (Figs. 97 and 98).

(1) Arch. Surg. 59:502-506, September, 1949.

PROCEDURE.—The tube is passed into the stomach and its position proved by aspiration The lower balloon is inflated to a diameter of 2½-3 in and the tube is pulled up so that the balloon engages snug-

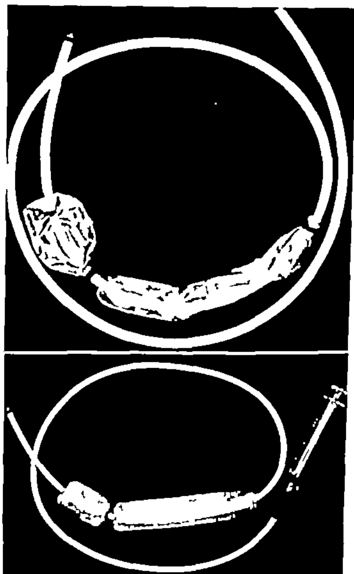


Fig. 97 (top) —Double balloon tube.
Fig 98 (bottom) —Tube inflated.
(Courtesy of Patton, T B., and Johnston, C. G Arch. Surg 59 502 506 September 1949)

ly at the cardia, which acts as anchor on the gastric side. The tube is taped to the nose, and the upper balloon is inflated with 200-250 cc. air The tube is left in place for 12 hours with constant suction in the stomach. The upper balloon is then deflated and, if there is still evidence of bleeding is again inflated and left in place for an

other 12 hours The third small lumen may be used for administration of thrombin after the method of Daly the thrombin being introduced just above the upper balloon If bleeding has stopped after 12 hours and deflation of the balloon material aspirated from the stomach will be blood free However, the tube is left in place The patient is started on sips of fluid and gradually put on a full diet about the third day Supportive treatment must also be carried out during the procedure

The authors have used the tube successfully in six cases and have had two failures one in a moribund patient in whom the balloons were not checked for adequate inflation the other in a patient found to have a bleeding duodenal ulcer

Balloon Tamponage for Control of Hemorrhage from Esophageal Varices The tube described by Robert W Sengstaken and Arthur H Blakemore[2] (Presbyterian Hosp., New York City) has a generous-sized main central lumen which permits aspiration of old blood from the stomach and feeding in certain cases There is also a distal balloon which, when inflated in the stomach has the primary purpose of a marker for quick and proper positioning of the upper sausage-shaped esophageal balloon. Tubes to the balloons are relatively small and are incorporated in the outer wall of the large tube An important feature of the esophageal balloon is that the lower third is reinforced with a double thickness of rubber This prevents it from expanding globular fashion into the stomach reducing its efficiency This specially designed balloon was used in 30 patients for control of bleeding esophageal varices without standing success. The tube and balloons were well tolerated for long periods In addition to its usefulness in cirrhosis and bleeding esophageal varices, it may be used in preparing patients with portal hypertension, complicated by hemorrhage for the portacaval shunt operation When so used, 13 of 15 patients with repeated attacks of hematemesis obtained operative relief by establishment of portacaval shunts.

Man, 36, with Laennec's cirrhosis, had been treated for a year under the Patek regimen and showed decided improvement in liver function, although hepatosplenomegaly persisted and x rays of the esophagus after barium swallow showed large, extensive varices. During 21 days this patient had nine episodes of hematemesis which

(2) Ann. Surg 131 781 789 May 1950

required 22 pt. blood as replacement therapy The tenth hematemesis measured 2,700 cc. and required 12 pt. blood over 12 hours for severe shock. Bleeding was promptly checked by a reinforced esophageal balloon and the portal vein was anastomosed end to side with the vena cava. The patient recovered No further hemorrhages had yet occurred after nearly a year

On the basis of $30 00/pt. for blood this patient alone could have equipped 55 community hospitals for balloon tamponage

Packing of Mediastinum in Treatment of Hematemesis Due to Esophageal Varices John H Garlock and Max L Som[3] *(New York City) took advantage of the communi*cating system at the cardia between portal and caval circulations to produce a new periesophageal plexus surgically, since they thought that there would be a rerouting of portal blood from the vulnerable submucosal varices to the new plexus, mainly because of the decided differences in pressure in the two circulations. They *performed* the procedure in eight cases At first, they packed only the upper mediastinum, but then extended the operation to include, as a second stage in selected cases, packing of the entire posterior mediastinum.

TECHNIC.—Through a left oblique cervical incision along the anterior border of the sternocleidomastoid muscle, the retroesophageal area is exposed by retracting the carotid sheath laterally and the thyroid medially The lateral and posterior surfaces of the esophagus are bluntly separated from the prevertebral fascia as far down in the mediastinum as the finger will reach, usually in the vicinity of the aortic arch. Into this space dry plain gauze is packed not too tightly the end emerges from the lower angle of the incision, which is then sutured throughout most of its extent.

To pack the lower posterior mediastinum a long incision is *made over the right seventh rib, which is resected subperiosteally* The chest is entered, a rib spreader inserted and a longitudinal incision made along the mediastinal pleura, the flaps of which are preserved for later use in closure. The esophagus is carefully freed from its mediastinal bed from the aortic arch almost to the diaphragm. Three strips of 1 in., single thickness gauze are placed along the esophagus. A channel is bluntly dissected between the parietal pleura and the rib cage, and the long ends of the three packings are withdrawn beneath the lateral flap of mediastinal pleura into this channel and brought out extrapleurally through a stab wound in a subjacent intercostal space. The incision in the mediastinal pleura is repaired, effectively covering esophagus and gauze packings. The chest is

(3) New York State J Med. 50 197 200 Jan. 15 1950

closed without drainage after inflating the lung The packings may be teased out of the stab wound without difficulty after 12 14 days preferably with the patient under anesthesia

In the eight patients there was considerable evidence that after the packing operation periesophageal collateral circulation developed It was also noted that when subsequent hematemesis occurred it was not as severe or profuse as previously indicating that some of the venous load had been taken from the submucosal varicose network Further experience with a larger series will indicate whether the operation has any merit in portal hypertension due to hepatic cirrhosis When hematemesis is the presenting symptom and esophagography discloses varices, the authors advise that the simpler operation of mediastinal packing in one or two stages be carried out before considering the more extensive and complicated venous shunt procedures

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ABDOMEN—GENERAL

Gastrointestinal Gas Observations on Belching during Anesthesia, Operations and Pyelography, and Rapid Passage of Gas Walter G Maddock John L Bell and Myron J Tremaine[4] (Northwestern Univ) state that external air enters the esophagus under many conditions and is the major source of gastrointestinal gas It appears in the upper alimentary tract of infants within 15 minutes after birth and the roentgen finding of air in the bowel has been suggested as a test for extrauterine life Normally the superior esophageal sphincter keeps the esophagus closed With swallowing movements the sphincter relaxes and air enters with fluid and food In the upright position the air collects at the top of the stomach when more than the usual amount accumulates as with a meal it is belched up The air sucker can consciously relax the superior esophageal sphincter and by attempting to breathe against a closed glottis can inspire or aspirate air into the esophagus from which it passes into the stomach The aerophagic is a nervous person who unconsciously does the same thing The

(4) Ann. Surg. 130 512 527 September 1949

laryngectomized patient can learn esophageal speech with air aspirated into the esophagus by the method of the air sucker, with skill his aspirations occur with almost normal inspirations and are practically unnoticeable The person who belches repeatedly takes air into the esophagus to belch with by *the same method as the air sucker, and some* can say a few words with the eructated air in the same manner as the esophageal speech patient

Patients undergoing anesthesia and operation were found to swallow infrequently, and little gas was aspirated from the stomach in the majority studied One patient breathing against a partially obstructed airway took in a large amount of air during the operation some relaxation of the superior *esophageal sphincter by the anesthetic probably played a* part. Considerable gas was aspirated from the stomachs of five patients during operation under cyclopropane anesthesia plus curare which probably *relaxed* the sphincter well while positive pressure *forced* gas into the stomach. A rare case of massive spontaneous pneumoperitoneum resulted from perforation of the stomach which became tremendously dilated during a minor operation under pentothal® sodium anesthesia

Air was found to pass rapidly through the *gastrointestinal* tract. Volumes aspirated into the stomach by experimental *subjects reached the cecum in an average of 14 6 minutes* and passed as flatus in 30 minutes Oxygen passed along in the same rapid manner

An excellent opportunity to study rapid accumulations of intestinal gas was offered by patients undergoing pyelography By continuous gastric suction considerable volumes of air were aspirated from the stomach and no increase in intestinal gas occurred this is further evidence that *external air is a major source of gastrointestinal gas.* Nervous patients had three times as much air aspirated from their stomachs as calm patients The stimuli of the various *manipulations increased the depth of respiration in these* patients and the gas return was greatest during the periods of manipulation A previous study of normal subjects showed that increased depth of respirations increased negative intraesophageal pressure and consequently the rate of aspiration of air into the esophagus

[These interesting findings can hardly explain the excessive amount of gas in the intestine in cases of ileus.—Ed.]

Use of Urecholine* in Prevention of Postoperative Distention Clarence F Stafford, Arthur J Kugel and Alexander Dederer[5] (College of Med Evangelists, Los Angeles) compared 100 patients who received 10 mg urecholine* three times daily sublingually after various major surgical procedures with 100 patients who received no routine prophylactic measures to prevent gas discomfort after similar types of surgery In the control group 28 per cent had no evidence of abdominal distention however in the urecholine* treated group 45 per cent were free from abdominal distention Although dosage was increased to 20 mg in some cases, no undesirable side effects were noted

When urecholine* was administered subcutaneously in doses of 5 mg., there was passage of flatus and stool five minutes after injection in some cases A few patients complained of sweating nausea and increased abdominal cramps but these effects usually subsided in 15-20 minutes This procedure gave satisfactory therapeutic results after other methods failed

These results indicate that the routine use of urecholine* in the postoperative patient will reduce the incidence of abdominal distention The sublingual route has the advantage of simplicity of administration. Urecholine* may exert a bronchoconstrictor effect like other choline esters and should be used with caution in cases with a history of asthma or allergy It should not be used with acute inflammatory lesions of the gastrointestinal tract or associated peritonitis when the stimulation of peristalsis may spread infection.

Abdominal Distention Treatment with Stigminene Bromide, New Cholinergic Drug is reported by James C Whitaker and Louis T Wright[6] (New York City) Of 92 patients representing abdominal genitourinary, thoracic and gynecologic operations 54 were treated prophylactically and 38 for established distention In 81.5 per cent of those treated prophylactically, distention did not occur Of those with established distention, it was mild in 4 moderate in 16 and

(5) Surg., Gynec. & Obst. 89 576-5 2 November 1949
(6) New York State J Med. 50 437 440 Feb 15 1950

severe in 18 Of the 92 patients, 48 had abdominal distention. It subsided in 4 hours in 14 in 8 hours in 11, in 12 hours in 16 and in 24 hours in 4 It lasted more than 24 hours in only three patients all with established distention.

In most cases 0 5 mg stigminene bromide was given intramuscularly at three, four and six hour intervals in courses of six injections, repeated if indicated The minimal number of doses was 1, the maximal 22 Except for three patients who had urinary tract operations and one who had catheterization for culture, urinary retention occurred in only one patient, and it required only a single catheterization No patient had evidence of lacrimation or salivation 13 complained of nausea and 12 had vomiting an incidence no higher than that in any group of major operations In 33 patients who had gastrointestinal tract operations, there was no deleterious effect from the drug Contraindications to the use of this drug are mechanical obstructions of the intestinal tract and asthma Patients with bradycardia, heart block respiratory difficulty or pulmonary pathology should be treated with extreme caution. The specific antidote for the cholinergic effects of stigminene is atropine

Effects of Sympathectomy on Motility of Human Gastrointestinal and Biliary Tracts in patients with essential hypertension was studied by John R Bingham Franz J Ingelfinger and Reginald H Smithwick˜ (Boston Univ) Balloon kymograph recordings of motility of small intestines were made in 19 patients The difference in preoperative tracings and those obtained more than three months after preganglionic sympathectomy were neither striking nor constant. Postoperative records indicated moderately increased over all activity

Gastric and intestinal motility was observed in six patients after a standard barium meal The only change after sympathectomy was a slight delay in transit of barium in the small bowel. Gastric tone peristalsis, emptying and small intestinal pattern were not altered Postoperative observations were made two weeks to one year after surgery

( ) Gastroenterology 15 6 17 May 1950

A careful gastrointestinal history was obtained from 300 consecutive patients who had undergone sympathectomy up to 10 years previously. About 20 per cent had increased frequency of bowel movements which did not appear to be affected by duration of the postoperative period. There was no obvious change in other symptoms such as borborygmus, bloating and flatulence.

Graham-Cole tests in 11 patients indicated that the gallbladder takes up dye and empties satisfactorily after sympathectomy. Physiologic salt solution was perfused under pressure through a T-tube in the common duct of two patients who underwent both choledochostomy and bilateral sympathectomy. Resistance of the sphincter of Oddi and duodenum to perfusion of the common duct was not affected by sympathectomy in one patient and was increased by a questionably significant amount in a second.

These observations suggest that the gastrointestinal and biliary motility in man are not appreciably changed by preganglionic sympathectomy.

Effects of Sympathectomy on Abdominal Pain in Man. John R. Bingham, Franz J. Ingelfinger and Reginald H. Smithwick[8] (Boston Univ.) produced intestinal pain in normal and sympathectomized subjects by inflating balloons in the small and large bowel and biliary tract pain by perfusing physiologic salt solution under pressure through a T-tube in the common duct.

Pain was produced in 25 of 27 normal subjects by distending the middle and lower thirds of the esophagus. It was described as a pressure or knot sensation and was experienced substernally over the balloon site. Duodenal pain typically appeared in the upper epigastrium in the midline deep inside the abdominal cavity, closer to the anterior than posterior abdominal wall. By injecting more air the pain was made more diffuse with radiation into the back. It was variously described as burning, cramping, sickening or as an expanding pressure. Biliary tract pain was similar to that produced by balloon distention. Jejunal and ileal pains were similar to duodenal pain except that they were situated a little lower.

(8) Gastroenterology 15:18-33, May 1950.

On the other hand, the integrity of *nerve conduction in the* sensory fibers is necessary Thus it is possible to explain why intestinal apoplexy occurs despite use of a general anesthesia The infarct is not produced a few days after nerve section when degeneration of the peripheral fibers detached from the cellular body has occurred.

The process seems to be released through production of the so-called axonic pseudoreflex, described by Langley in the somatic sensory nerves but occurring here in the sensory fibers of the sympathetic Such an occurrence is possible since these two types of sensory fibers have the same anatomic constitution and distribution and identical physiologic properties. Sensory excitations can pass against the current and exert centrifugal action without any necessity for the nerve influx to travel to the original cell of the axon. This mode of reaction explains production by simple local irritation of pathologic manifestations without intervention of the vegetative nerve centers On the other hand, histologic studies show that the process begins with vascular changes, preferably localized between the two muscular layers where most of the sensory fibers of the sympathetic end

It is therefore believed that irritation of the sensory fibers rebounds by antidromic conduction, producing vasodilatation of the capillaries, venules and arterioles, increase of capillary permeability, edema and the entire gamut of lesions which characterize the reversible infarct. These vascular reactions are similar to the triple reaction described by Lewis for irritation of a cutaneous sensory nerve A similar mechanism is accepted by Leriche to explain vasodilatation in traumatisms, sprains, etc

To explain the intestinal mesenteric infarct, the authors accept Grégoire's anaphylactic theory of intolerance to heterologous albumins which reach the intestine repeatedly the reactions being similar to those of *the local phenomenon* of Arthus. The factor releasing the changes is probably an antigen (alimentary, allergic infectious, etc.), which gives rise to an antigen antibody reaction via the blood stream this interaction results in cellular injury with liberation of products of protein disintegration, which, as a result of irritation of the sensory fibers of the sympa

thetic, produce an axonic reflex that in turn produces the vasomotor phenomena characterizing the infarct

Acute Abdominal Manifestations of Sickle Cell Disease Report of Three Cases, with Laparotomy in Two is made by Philip Crastnopol and Charles F Stewart[2] (New York City) Altogether 23 patients with sickle cell disease were observed, 8 of whom complained of symptoms that were predominantly and recurrently gastrointestinal The longest duration of symptoms was 17 years In many patients a crisis would begin with vague generalized abdominal pain or discomfort In some symptoms were referable to the cardiovascular system and often rheumatic fever was suspected since there was associated arthralgia prostration fever pain in the chest hemic murmurs and borderline electrocardiographic abnormalities with x ray evidence of enlargement of the heart There were three deaths

In two cases abdominal exploration was performed Postoperatively, it was found that one patient had a crisis in sickle cell anemia The second patient was an infant aged 1 month, who was known to have the disease but died soon after operation for suspected intussusception Laparotomy disclosed only moderately severe mesenteric adenitis In a third case diagnosis was acute appendicitis but operation was not performed when it was found that the patient had sickle cell anemia

Because of this experience it is recommended that Negroes have a routine examination of a wet preparation of the blood on admission to rule out sicklemia if there is a question of an abdominal condition requiring surgery When the familial or past history is positive or when icterus, hepatomegaly or abdominal pain is noted, a hanging drop preparation should be examined for sickling The Winsor Burch parameter test may be useful for diagnosis of sickle cell anemia. In one patient this test showed differences in sedimentation rates between anoxic and well oxygenated blood of 47 mm /hour in the first and 92 mm /hour in the second determination

The cause of abdominal distress in sicklemia is controversial. Abdominal pain may be due to mesenteric and retroperitoneal lymphadenitis, hemopoiesis or thrombotic

(2) Arch. Surg. 59 993 1000 November 1949

episodes coexistent with hepatitis, splenitis or perisplenitis.

Peritoneal Pseudomyxoma is relatively rare. Of over 8,100 consecutive autopsies at Montefiore Hospital since 1917 only three disclosed this disease, to these three cases may be added a fourth diagnosed at laparotomy and in which there was no autopsy Eugene D Rosenfeld[3] (New York City) reports four unusual cases in which surgical specimens proved difficult to evaluate and were usually reported as mucogenic adenocarcinoma. The first three cases occurred in men, the fourth in a woman.

Hypoglycemia was an incidental finding in the second case and reached shock levels in the first. In the third there was massive infarction of the spleen as a result of com pression of the splenic vein and massive encapsulation of the organ by the cystic mucinous growth. The fourth was remarkable because of the good result obtained with surgi cal treatment and because death resulted eventually from a perforated mucocele of the appendix.

In the absence of any conclusive evidence establishing the cause of the hypoglycemia in the first case, it is best explained on the basis of a combination of faulty absorp- tion hepatic insufficiency and debilitation resulting in suffi cient depletion of glycogen, protein and fat stores that with holding of food precipitated episodes of hypoglycemia. After six weeks of high protein diet and when it was no longer necessary to withhold food for any purpose, the attacks ceased. Peripheral edema likewise subsided, al though the abdominal mass continued to grow In two of the other three cases reported peripheral edema also dis- appeared on high protein diets.

Despite repeated laparotomies, the nature of the illness was not appreciated in three of the four cases and was correctly diagnosed only in Case 2 at the second operation. Two factors are responsible for this failure of diagnosis absence of a demonstrable mucocele because the appendix had been removed before onset of symptoms (Case 3) or the appendix had been buried in the mucinous mass (Case 1) and reports on biopsy material consistent with colloid or mucogenic adenocarcinoma Case 2 was recognized as pseu domyxoma only when a mucocele of the appendix was seen.

(3) Arch. Path. 48:258-273, September 1949.

Even in the presence of cells thought to be cancerous, a diagnosis of peritoneal pseudomyxoma should be entertained when the history is consistent and laparotomy shows a peritoneum infiltrated with gelatinous cysts, even in the absence of demonstrable mucocele of the appendix The finding of a mucocele should expedite matters The important point is that the diagnosis is essentially a gross anatomic one and that relying on the microscopic changes may often erroneously prohibit the correct diagnosis

More attention should be paid to the possibility that in females peritoneal pseudomyxoma may originate in the appendix even in the presence of ovarian cystadenoma or cystadenocarcinoma, and that the appendix should be removed whenever there is the slightest doubt as to the differential diagnosis. Credence is given to the possibility that even in females the appendix and not the ovary may be the site of origin of peritoneal pseudomyxoma.

Meconium Peritonitis is uncommon, since only a few over 100 cases have been reported. About 50 per cent are associated with demonstrable intestinal obstruction, and the bowel perforation usually closes prenatally so that often its site cannot be found at operation or autopsy The peritoneal reaction is that of a chemical or foreign body peritonitis with meconium deposits, formation of dense adhesions, agglutination of loops of bowel and calcification. For the other 50 per cent without demonstrable organic obstruction, many causes have been listed, but there is no satisfactory explanation for the perforation. Many of the children are born dead or die soon after birth, those who survive present a picture of intestinal obstruction. J Richmond Low George Cooper Jr., and Lewis Cosby, Jr[4] (Univ of Virginia) report a case.

Child, aged 4 days, admitted for intestinal obstruction, had a moderately distended, soft and doughy abdomen In the right lower quadrant was a soft, indefinite mass about 3 cm. in diameter No peristaltic sounds were heard. Abdominal films showed gas in the stomach and small bowel loops of the left upper quadrant only There were fluid levels in the upright position. Fine calcifications were scattered throughout the abdomen. There were a few linear deposits on the inner surface of both lateral abdominal walls, a collection of small deposits in the left side of the pelvis and another

(4) Surgery 26 222-228 August 1949

large collection in the region of the cecum. Diagnosis was intestinal obstruction proximal to the colon and meconium peritonitis. The latter is often associated with atresia of the ileum. Fluids were given intravenously, and a catheter was passed into the stomach and connected to a continuous suction apparatus. After seven hours' treatment the child had improved considerably

A right rectus muscle-splitting incision was made. The peritoneum was markedly thickened and inflamed and in it were areas of calcification. The cavity was entered with difficulty because of agglutination of bowel to anterior peritoneum and of bowel loops to one another Immediately beneath the incision was a dilated loop of small bowel about 2.5 cm. in diameter and 5-6 cm. long, it was dissected free and found to end in a blind pouch. Adjacent to this was a small collapsed loop about 8 mm. in diameter which also ended in a blind pouch. This segment was dissected out and found to enter the cecum about 7 cm. distally It became apparent that there was complete atresia of the terminal ileum. The mesenteries of the two blind loops were continuous with each other The proximal bowel was thickened and friable but its blood supply seemed adequate. The two loops were brought together side to side in antiperistaltic manner and an anastomosis about 2 cm. long was performed. Several biopsies of the peritoneum were taken, 100 000 units of penicillin and 0.5 Gm. streptomycin in solution were placed in the region of the anastomosis and the wound was closed in layers. The child was discharged one month after admission At age 37 weeks he was well developed and well nourished and appeared entirely normal. A flat x ray film of the abdomen showed striking diminution of the calcium deposits in comparison with earlier films.

Roentgenologic and Clinical Correlation of Acute Abdominal Disease Analysis of 100 Cases is presented by Benjamin S Brown[5] (Western Reserve Univ) The views taken routinely in these cases include (1) upright posteroanterior view of the chest to show free air beneath the diaphragm or any pathologic process in the chest (2) anteroposterior view of the abdomen in a recumbent posture to show presence and distribution of gas in the intestines (3) lateral supine view of abdomen to show presence of fluid levels and abdominal distention. These views can be made with minimal discomfort to the patient and they give maximal information.

An accurate history and physical examination are essential in diagnosing ileus and in differentiating between the mechanical and paralytic types. The x ray manifestations of acute abdominal disease include (1) air in the intestine

(5) Am. J Roentgenol. 63 328-329 June 1950

(a stepladder or herring bone pattern suggests obstruction of the small intestine, whereas a lateral abdominal distribution of gas suggests obstruction of the large intestine), (2) fluid levels in the bowel, (3) free air in the peritoneal cavity and beneath the diaphragm, suggesting perforated viscus (4) free fluid in the peritoneal cavity, and (5) abdominal distention

The final x ray diagnosis was paralytic ileus in 63 cases, mechanical ileus in 30 and miscellaneous diagnoses in 7 Diagnosis was proved clinically in only 37 per cent, by surgery in 58 per cent and at autopsy in 5 per cent On this basis, final x ray diagnosis was correct in 90 per cent of cases of mechanical ileus, in 74 per cent of cases of paralytic ileus, in 30 per cent of miscellaneous cases and in 76 per cent of all the cases The most frequent causes of paralytic ileus were appendical abscess, perforated viscus other than peptic ulcer, pelvic inflammatory disease, perforated peptic ulcer and peritonitis The most frequent causes of mechanical ileus were adhesions of the small intestine and carcinoma of the colon.

The symptoms of nausea, vomiting and pain were common to both types Peristalsis was decreased in 33 per cent of patients with mechanical ileus and gas was found in the large and small intestines in 23 per cent Fluid levels were present much more commonly in mechanical than in paralytic ileus Mechanical ileus occurred most often between ages 50 and 65 paralytic ileus showed no special age distribution.

Approach to Upper Abdomen. Charles Gale[6] suggests that most upper abdominal lesions may be best approached through an abdominal incision resembling the lower portion of Humphreys incision He describes the right and left upper oblique abdominal incisions each of which may be extended at its inner end to allow access to the other side of the abdomen and at its outer end into the thorax. Compared with the vertical incisions the access obtained is superior, closure is more readily performed and appears to be stronger, and postoperative discomfort is much less.

Technic.—The right upper oblique incision begins 1 in. above and to the left of the umbilicus and passes with a slight curve toward

(6) Australian & New Zealand J Surg 19 86-90 August, 1949

the right rib margin and then along the seventh intercostal space for 4 in. from the costal margin, so that a straight line connecting its ends makes a 30-40 degree angle with the waist line (Fig 99, *A*) The incision is deepened until the anterior rectus sheaths and linea alba are exposed medially and the external oblique muscle fibers laterally These fibers are split, and the anterior rectus sheath is incised. The rectus muscle is divided by gentle cuts, and the vessels are picked up as they become exposed. The posterior rectus sheath and peritoneum are incised lateral to the falciform ligament and the incision is carried laterally to the rib margin, the internal oblique and transversus muscles and the peritoneum being cut as one piece The incision is carried to the left through the falciform ligament, linea

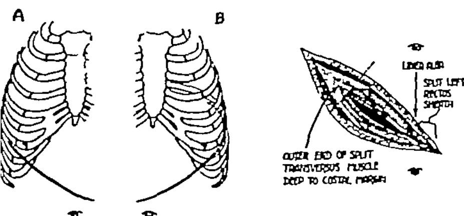


Fig 99 (left) —*A* right upper oblique incision. *B* left upper oblique incision extended to form Humphreys' incision.
Fig. 100 (right) —Completed right upper oblique incision.
(Courtesy of Gale O.: Australian & New Zealand J Surg. 19:36-39 August, 1949)

alba and left anterior and posterior rectus sheaths for about 1 in., the left rectus muscle being retracted to the left (Fig 100) Application of forcible retraction to each wound edge medial to the costal margin causes the transversus muscle and associated peritoneum to tear laterally for ¾ in. deep to the rib margin so that a triangular opening is established with its base formed by a 4 in. length of costal margin covered only by areolar tissue.

Closure is started at the left end of the incision, the suture approximating the peritoneum and rectus sheath behind the left rectus muscle. The peritoneum, in conjunction with the linea alba, right posterior rectus sheath and transversus muscle belly in succession, are sutured to within 1½ in. of the costal margin. A second suture then picks up the split peritoneum and transversus muscle at the right end of the incision on the deep aspect of the costal cartilages and is continued to the left to join the first suture. This method is easier than when a single suture is used, and it provides firm closure.

The left upper oblique incision is similar to the right (Fig 99 *B*) Gastric ulcer and carcinoma are approached

incision may be extended across the right rectus muscle in patients with a narrow costal angle If a considerable portion of the esophagus is to be resected, incision is best made in the seventh interspace. Adequate exposure should be obtained without resection of a rib if a Finochietto rib spreader is used. For operations on the spleen, liver and kidney, the diaphragm is best incised in the line of the skin incision In operations on the stomach or esophagus, incision should be made from costal margin directly into esophageal hiatus.

This approach makes readily accessible the entire stomach and its associated lymph nodes, lower half of the esophagus, spleen,

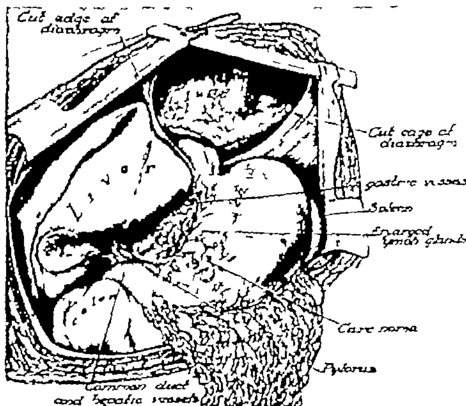


Fig 102.—Exposure of stomach obtained by combined thoracicoabdominal incision. (Courtesy of Carter B. N., and Hebsworth J. A.: Ann. Surg. 131 687-696 May 1950.)

pancreas, duodenum and transverse colon (Fig 102) In the case of cancer of the cardia of the stomach, the incision facilitates resection of the lower end of the esophagus and subsequent anastomosis. When there is a strangulated and grossly distended hollow viscus in a diaphragmatic hernia, the incision should be extended across the costal margin for varying distances into the abdominal wall and, by division of the diaphragm down through the constricting ring. The combined incision is useful in establishing a splenorenal shunt in cases of portal hypertension for it facilitates removal of an often

densely adherent spleen and permits adequate exposure of the left kidney and isolation of the renal vein. On the right side, the incision provides a highly satisfactory exposure of the vena cava and portal vein for performance of a portacaval shunt. After the diaphragm has been divided the right lobe of the liver can be dislocated upward into the thorax and the vena cava and portal vein easily brought into full view (Fig 103)

The only serious postoperative complications were two cases of empyema and two of instability of the lower thorax. The former may be prevented by drainage of the contami-

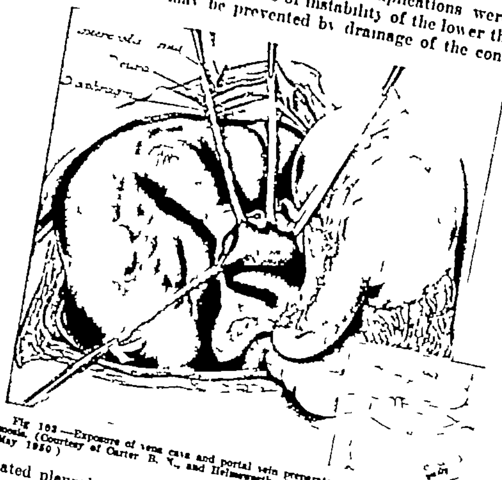


Fig 103 —Exposure of vena cava and portal vein preparatory to portacaval anastomosis. (Courtesy of Carter, B. N., and Helmsworth, J. A.: Ann. Surg. 131 687-696 May 1950.)

nated pleural cavity at operation and the latter by careful suturing of the severed costal margin with silk or fine steel wire after its cut edges are placed in anatomic position with a rib approximator (Fig 104) X rays of the thorax were made in 17 patients in 3 there was some restriction of motion of the diaphragm on the side of operation There was no instance of diaphragmatic hernia The incisions in

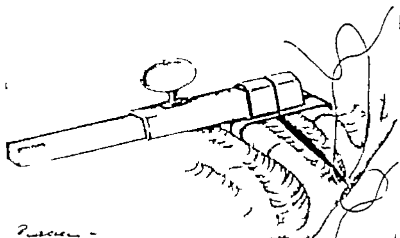


Fig 104 —Preventing instability of lower thorax by apposing the cut edges of the costal margin and placing silk sutures in them. (Courtesy of Carter B. N., and Helmsworth J A. Ann. Surg 131 687-696 May 1950)

the diaphragm of all patients were closed with simple interrupted or figure-of-eight silk sutures There was no instance of faulty emptying of the esophagus in 15 patients examined for this possibility

[There can be no doubt about the great value of a combined thoracoabdominal incision in many cases requiring an approach to the organs of the upper abdomen. As for the occurrence of empyema mentioned by the authors, it is always wise after opening a pleural cavity whether by simple thoracotomy or by combined thoracoabdominal incision, to institute water seal drainage for 24 or 48 hours. By withdrawing in this manner the collected fluid the lung remains expanded and there is much less chance of the development of empyema. This chance is still more diminished by the instillation of 100,000 units of penicillin into the pleural cavity immediately *after the chest is closed.* The water seal *catheter should be kept closed* for about four hours after the penicillin is introduced.—Ed.]

Postoperative Abdominal Wound Separation and Evisceration E. J Joergenson and Ernest T Smith[8] (Glendale, Calif) state that in 39 574 laparotomies performed at Los Angeles County General Hospital (1936-46) 97 eviscerations (0.245 per cent) occurred the incidence reported in the literature ranges from 0.2 to 2 per cent. There were 30 eviscerations in females and 67 in males, the highest incidence occurring in women aged 40-49 and in men aged 60-69

Primary and associated diseases that influence the nutritional state of the patient contribute to faulty wound healing There was a definite and in[illegible] rapid weight

(8) Am. J Surg. [illegible] uary 1950 [illegible]

loss in 42 Clinical diagnosis of avitaminosis was made in 15 cases At the time of surgery wounds in 27 patients were infected, and 14 had peritonitis Twelve had some form of respiratory disease with cough Twenty of 35 total serum protein determinations were below 6 4 Gm per cent. Hemoglobin ranged from 70 to 100 per cent in 46 of 69 determinations Red cell counts were over 4 000 000 in 32 of 47 cases and prothrombin values below normal in 9 of 25

Postoperative evisceration is essentially a complication of the vertical incision it occurred in only one transverse, one subcostal and one McBurney incision No suture material is immune to the accident Layer closure was used in 61 cases layer closure plus tension sutures in 16 and through and through closure in 9 Postoperatively, over one half the patients had had retching and emesis, distention, bloody discharge from the wound and an excessive febrile reaction cough was a distressing symptom in a little less than half Evisceration occurred from 2 to 18 days post operatively

In resecuring the wound strapping alone was used in 4 patients and resulted in 3 incisional hernias and 1 death strapping and delayed suturing was used in 16 and resulted in 8 cures 6 deaths and 2 hernias, immediate suturing in 77 resulted in 35 deaths 28 cures and 8 hernias. No follow up was possible in six cases The mortality rate was 43 8 per cent

Preoperative correction of nutritional deficiencies and restoration of normal fluid balance in dehydrated patients is indicated Chronic anemia as part of a general depletion should be overcome

Anatomic incisions should be used whenever possible It is essential that the technics of abdominal wound closure be constantly improved and symptoms suggesting deep wound separation heeded In clean wounds nonabsorbable sutures are recommended steel alloy sutures may be the choice in infection. The wound should be adequately protected and put at rest, but it must be examined before the skin sutures are removed and if the deeper layers have separated, it must be secured before removal of the skin sutures. Prompt recognition of evisceration, followed by emergency measures, is essential In secondary closure local

anesthesia is usually preferred if a general anesthetic is indicated, pentothal* sodium, oxygen and curare is recommended Postoperative care must be individualized and closely supervised

Disruption of Abdominal Wounds is discussed by William L Wolff[9] (Veterans' Admin. Hosp., Bronx, N Y) On the basis of 45 cases occurring in 1,700 consecutive abdominal operations, an incidence of 2 6 per cent, the causative factors were analyzed Age over 45 and hypoproteinemia were related to an increased frequency of dehiscence There was a higher incidence in white persons than in Negroes. Season of the year, vitamin C deficiency, anemia and sensitivity to catgut were not significant determinants in this series. Cancer could not be divorced from age and other factors as a predisposing condition.

The type and location of incision did not materially influence the disruption rate, except for the McBurney incision which afforded a high degree of protection. Bringing a viscus out through the incision, as in colostomy or gastrostomy definitely increased the risk, use of drains generally did not. Disruptions occurred despite retention sutures in several cases

Care and technic in closure are extremely important factors in wound healing, and atraumatic closure and exact approximation of the peritoneal layer are the most essential aspects A stitch which everts the peritoneal edges not only prevents adhesions but favors early sealing of the inner surface of the wound.

Postoperative complications, particularly coughing and vomiting are pernicious influences and intensive efforts should be directed at prevention and control. Early ambulation appeared to be without danger Two disruptions occurred during tracheal stimulation on the operating table and others had their start in this manner Prevention is rather simple When clearing the endotracheal tube before withdrawal and whenever tracheal toilet or bronchoscopy is contemplated, the patient should be in a sufficiently deep plane of anesthesia to avoid stimulation of violent cough reflexes if deep anesthesia is not warranted near the end

(9) Ann Surg. 131 534 535 April, 1950

of operation, the anesthetist can cautiously use curare preparations. Perhaps a better procedure is to have the surgeon notify the anesthetist just before closing the abdomen; the tracheobronchial tree can then be thoroughly cleansed and only accumulation during wound closure need be aspirated at the end of operation.

Clinically, many disruptions start much earlier than the day on which they are discovered. Treatment depends on the condition of the patient. If the patient's condition permits, secondary closure is preferable; if not, resort must be made to tamponade and adhesive strapping.

Mortality in the series was 11.1 per cent. Of the five deaths one occurred 35 days after disruption, an additional operation being done in the interval, and one the day after closure of the disruption when the patient pulled out a Miller-Abbott tube and started uncontrollable bleeding from esophageal varices. Three patients died 5, 3 and 28 days respectively after disruption, the original disease and operation apparently being chiefly responsible.

Follow-up, even though incomplete, showed a significant incidence of incisional hernias (12 in 38 patients) regardless of treatment. Many incisional hernias result from unrecognized or concealed wound separations.

Review of Wound Disruptions. George B. McAdams[1] analyzed 48 cases of wound disruption (0.25 per cent of the abdominal procedures performed at the Hartford Hospital from 1935 to 1948). There were 39 men in the series. In 27 per cent of cases the primary diagnosis was cancer and in about one fourth biliary tract disease. Aside from midrectus or midparamedian incisions, 68.7 per cent of the incisions were above the umbilicus; there was one subcostal incision. Since their advent, wire sutures were used in the fascia in about 40 per cent of the cases; in the others gut was used.

In half the cases coughing either was the precipitating cause or was at least mentioned frequently in postoperative notes. Vomiting, ileus, peritonitis and wound infection were regarded as less frequent factors. Dehiscence appeared in about 7½ days and evisceration, when it occurred, about a day earlier.

(1) Connecticut M. J. 14: 604-611, July 1950.

Through and through braided silk was used for resuturing in half the cases and through and through silver wire in one fourth. In the latter, 50 per cent of the patients eventually died, whereas only 20 per cent of the former cases proved fatal Average age in the fatal cases was 56 as compared with 50 in the group as a whole There were 19 deaths, a mortality of 39 6 per cent. Three of 6 patients with chronic cholecystitis, 8 of 13 with malignancies and 3 of 5 with perforated ulcers died Autopsies in 10 cases disclosed peritonitis in 6, small bowel fistulas in 2 and atelectasis in 1 but failed to reveal the cause of death in the other

Relief of Postoperative Pain and Its Influence on Vital Capacity H. E Pooler[2] (Chesterfield Royal Hosp) noted pulmonary complications in 19 per cent of 331 patients after upper abdominal surgery, in 10 9 per cent of 1,334 after lower abdominal operations and in 0 7 per cent of 4,204 after extra abdominal operations The higher incidence of complications after abdominal operations is attributed to impaired postoperative respiratory movements and reluctance of the patient to cough, both of which are probably due to the pain elicited by such efforts Since morphine is a respiratory depressant, it is not the ideal drug for pain relief when it is also desirable to increase respiration.

To relieve postoperative pain so that respiratory movements are unimpaired and the patient can cough freely, a slow intravenous drip of 1 Gm. procaine in 1,000 ml. of 5 per cent dextrose in normal saline (0 1 per cent procaine solution) is recommended When relief from pain is noted, usually in a few minutes, the patient is encouraged to cough until sputum is produced and then to carry out routine breathing exercises. Since subjective symptoms of over dosage with procaine rarely occur the patient need not be under personal supervision for more than the first few minutes. Relief from pain lasts as long as eight hours, during which breathing exercises and coughing should be continued vigorously

[The fact that postoperative pulmonary complications are most common after upper abdominal operations has, of course, been known for many years. The observations by Elkin and others that the vital capacity is

(2) Brit. M. J 2 1200-1203 Nov 26 1949

greatly reduced after such operations indicated that pain was probably chiefly responsible for the diminution in amplitude of the respiratory movements and likewise for the unwillingness of patients to cough. Atelectasis is therefore likely to follow. The suggestion of Cooler seems to be logical.—Ed.]

Deperitonealization Clinical and Experimental Observations. It is generally believed that in abdominal surgery areas denuded of peritoneum should be reperitonealized to prevent adhesions of loops of bowel to these areas which would favor angulations and torsions of the bowel and thus cause intestinal obstruction However, so far Guy F Robbins, Alexander Brunschwig and Frank W Foote[3] (New York City) have encountered no instances of postoperative obstruction due to adhesions alone in several months to years after radical excisions of large intra abdominal neoplasms in which reperitonealization of the denuded areas was impossible They have had the same experience in numerous cases of excision of pelvic viscera in which the entire true pelvis was stripped of its peritoneal covering and the small bowel allowed to descend into the pelvis and come in contact with the musculofascial and osseous surfaces of the pelvic walls They therefore carried out experiments on dogs to observe what might develop in the peritoneal cavity after large areas were stripped of peritoneum or after the abdominal wound was closed without approximation of peritoneum.

It appears that the denuded parietal surfaces readily heal by proliferation of peritoneum at the margins of the area and/or by condensation of connective tissue in the area to form a new smooth glistening surface membrane (peritoneum) Such reconstitution of peritoneal surfaces seems to be the normal sequence unless other factors intervene such as infection or the as yet undefinable tendency of some individuals to react to trauma by overproduction of fibrous tissue with dense collagenous interstitial substance

A feature of special interest is encountered in patients in whom all musculofascial components of the abdominal wall are excised leaving skin and subcutaneous fat only During the months after such procedures the abdominal wall appears to have become thickened, denser and less elastic, indicating that the fibrous tissue elements in these

(3) Ann. Surg. 130 466-479 September 1949

areas have proliferated to add strength to the abdominal wall. Two illustrative cases are reported, in one of which reoperation was done one year later no adhesions were found between underlying loops of small bowel and the denuded parietes, and a peritoneum like membrane had formed over the denuded area

This study is not presented to indicate that complete disregard for reperitonealization is advocated It simply shows that reperitonealization is not of sufficient importance to weigh heavily in determining the mode of procedure for radical extirpation of abdominal malignant neoplasms Furthermore it may be inferred that, after a complex and lengthy procedure, prolongation of the operation for meticulous approximation of the peritoneal layer in wound closure is not important enough to delay appreciably termination of the procedure and return of the patient to bed

Systemic Administration of Heparin and Dicumarol* for Postoperative Adhesions In preliminary studies, Maurice M. Davidson[4] (Roselle Park, N J) subjected 37 dogs to 108 procedures in an attempt to control postoperative adhesions by trans- or intraperitoneal operations Early ambulation, careful peritonealization of raw surfaces eversion of peritoneum by interrupted sutures in closure avoidance of compressive wound dressings, pneumoperitoneum and *infusions of slowly absorbed solutions like gelatin* were all partly effective in reducing incidence of visceroparietal adhesions, although viscerovisceral adhesions nearly always occurred. To combat the latter, infusions of heparin in isotonic salt solution, in 20 per cent gelatin and in Pitkin's menstruum were used with reduction of 50-75 per cent in both kinds of adhesions. Best results were secured with 20 per cent gelatin as vehicle The chief complication was intraperitoneal bleeding but this was absorbed in practically all instances, hemoglobin content returning to within 10 per cent of normal by the fourth postoperative day The least bleeding occurred when gelatin was used as a menstruum.

In the second part of the study heparin and dicumarol* were given systemically alone and in combination in 64

(4) Arch. Surg. 59 300-325 August, 1949

experimental procedures divided into four groups Areas of serosa were not only abraded but also denuded (1) With heparin in Pitkin's vehicle visceroparietal adhesions occurred in 12 per cent and visceravisceral adhesions occurred between abraded areas in less than 1 per cent and in denuded areas in 56 per cent (2) With heparin in 20 per cent gelatin, visceroparietal adhesions occurred in 12 per cent and visceravisceral adhesions between abraded areas in 12 per cent and in denuded areas in 68 per cent. (3) With dicumarol® given orally visceroparietal adhesions were found in 37 per cent and visceravisceral adhesions in 50 per cent mostly in denuded surfaces Fatal hemorrhages occurred in 25 per cent Dosage and action of this drug were exceedingly difficult to control (4) With dicumarol® orally and heparin in Pitkin's base subcutaneously, visceroparietal adhesions were found in 31 per cent and visceravisceral adhesions in 56 per cent Fatal hemorrhage occurred in 12 per cent

It appears that heparin administered subcutaneously is an effective and relatively safe agent for reducing incidence of postoperative adhesions It is more effective subcutaneously than when infused intraperitoneally because its action is more constantly sustained It is more effective and controllable than dicumarol® or dicumarol® and heparin combined The hazard of serious hemorrhage also is much less

Granulomas of Large Size Caused by Implantation of Talcum (Talcum Sarcoids) G E Gruenfeld[5] (St. Louis) warns against the nefarious potentialities of talcum glove powder which in contact with living tissue may cause serious reactions in the form of chronic inflammations or tumefactions as late as 10 and more years after operation.

Woman 21 who 11 years previously had had an appendectomy through a short McBurney incision with uneventful recovery noticed a painless swelling in the right lower region of the abdomen for three weeks before presenting herself for examination. A nodular mass about 12 × 6 cm. was located beneath the operative scar in the deeper layers of the abdominal wall but did not involve the overlying skin which was considerably elevated by the mass. Consistency was firm and delineation from the surrounding tissues definite, the base was broadly attached to the aponeurosis of the external oblique muscle The mass was excised. Its configuration and consistency sug

(5) Arch Surg 59 917 921 October 1949

gested sarcoma, but microscopic sections revealed closely spaced small tubercles consisting predominantly of epithelioid cells, many of which were fused to form multinucleated giant cells with preserved staining behavior, whereas others exhibited deeper staining cytoplasm and therefore were possibly of different origin. This finding and absence of caseation led to the conclusion that the tumor was a foreign body granuloma. The foreign body reaction was subsequently proved to be due to talcum.

When tissue sections are viewed with polarized light the foreign substance in the giant cells can be identified, but expert petrographic analysis is needed to ascertain the chemical nature of the crystals, it should also be noted that cellulose fibers are similarly refractile to polarized light.

There are three possible logical explanations of talcum sarcoid and especially its conspicuous lag period (1) In comparatively few patients antibodies to one of the silicates contained in industrial talcum eventually develop, the interaction between talcum and antigen elicits a tissue response in the form of giant cell tubercles. (2) Minute mineral deposits of talcum act as localizers for certain unknown bacterial or viral organisms circulating otherwise harmlessly in the body (3) Mineral deposits prevent elimination of bacterial or viral contaminants introduced during surgical exposure, and clinically perceptible inflammations develop when the dormant organisms become virulent.

Application and Evaluation of Peritoneoscopy John C Ruddock[6] (Los Angeles) states that peritoneoscopy is the procedure of choice for intra-abdominal examinations in many circumstances however it cannot wholly replace laparotomy because its usefulness is limited to the visually accessible regions of the peritoneal cavity and because in some conditions it is definitely contraindicated It is particularly useful in patients who are elderly, emaciated, anemic or poor surgical risks for other reasons Its indications are differential diagnosis corroboration of diagnosis differentiation and localization of tumor masses determination of whether metastases are present biopsy pelvic examinations drainage of abscesses and cysts and guiding of exploratory needles, determination of sex (when external genitalia are not distinctive) of operability of a lesion and of extent of intra-abdominal injuries All patients with

(6) California Med 71 110 114 August, 1949

ascites of undetermined origin should be given the benefit of peritoneoscopy. All patients considered for peritoneoscopy should be carefully previewed and the procedure proscribed if it entails risk to the patient or if its intended purpose is anatomically impossible of accomplishment. As lesions inside a viscus or buried deep in the peritoneal cavity can not be visualized, patients with symptoms placing the disease in these locations should not be selected. Acute abdominal conditions, obstructive lesions in the large or small bowel and dilatation of the stomach are definite contraindications. In chronic illness, peritoneoscopy should not be done until the usual clinical and laboratory diagnostic methods are exhausted.

Peritoneoscopy is carried out in an operating room under aseptic conditions and local anesthesia, the point selected for puncture usually being about 1 in. below the umbilicus in the midline and as far away from operative scars as practicable. Aside from localized subcutaneous emphysema at the puncture site and occasional emphysema of the omentum, no untoward effects have been noted after distention of the abdominal cavity with air. When peritoneoscopy is done in infants and children, general anesthesia is necessary and the puncture must be made through the rectus muscle to avoid the possibility of producing hernia. Puncture of a viscus occurs only when it is firmly fixed by adhesions or is tensely dilated; it occurred 8 times, all in the first 900 of Ruddock's 2,500 cases. There were three deaths, but more recently the hazards which resulted in these deaths have been eliminated.

Age range in the series was from 6 months to 85 years. Sex distribution was about equal. About 1,000 biopsy specimens were obtained. In half the cases ascites was present. One third of the patients were proved to have malignant lesions, metastatic or primary. In 2 per cent the purposes of peritoneoscopy were not accomplished.

Treatment of Traumatic Hernia of Diaphragm Conrad R. Lam[7] reports that at Henry Ford Hospital acute traumatic hernia of the diaphragm was diagnosed only three times during 10 years The three hernias were repaired

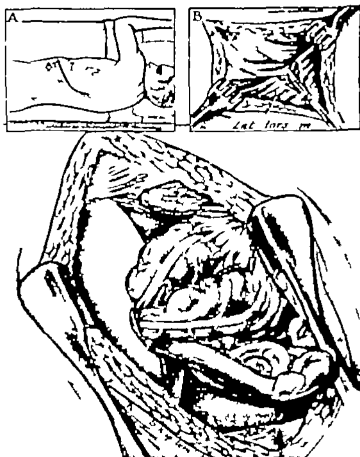


Fig. 103 —Steps in exposure of traumatic diaphragmatic hernia. (Courtesy of Lam, C. R.: Arch. Surg. 60 421-430 March, 1950)

immediately but not before one was complicated by perforation of the incarcerated stomach. Although the logical treatment appears to be prompt surgery two elderly patients had received different advice with the result that

(7) Arch Surg 60 421 430 March, 1950

they had had lengths of gastrointestinal tract in the thoracic cavity for 5 and 10 years An emergency operation was performed in one because of strangulation of small bowel in the hernia Traumatic diaphragmatic hernia may be discovered in relatively asymptomatic patients by timely use of the barium meal and enema

TECHNIC.—Under endotracheal anesthesia, a curving incision is made over the seventh interspace (Fig 105) from near the costal margin to a point just lateral to the spinous processes The latissimus

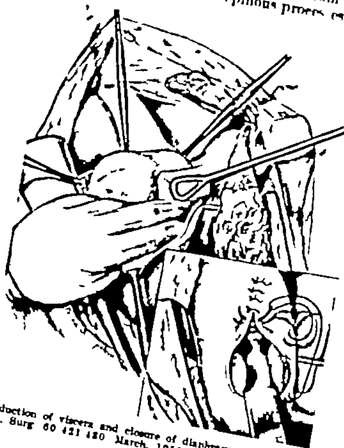


Fig 106 —Reduction of viscera and closure of diaphragmatic hernia. (Courtesy of Lam, C. R. Arch. Surg 60 421 180 March, 1950)

dorsi and any slips of the serratus anterior which are present are transected. The erector spinae tendon is retracted from the eighth rib which is cut subperiosteally medial to its angle. Intercostal muscles and pleura between the seventh and eighth ribs are cut with scissors and self retaining retractors are installed. The edges of the diaphragmatic opening are grasped with Allis forceps and reduction is begun (Fig 106) If motion of the diaphragm is a hindrance, the phrenic nerve may be crushed or blocked with procaine. With acute hernia, reduction should be comparatively easy With long-standing

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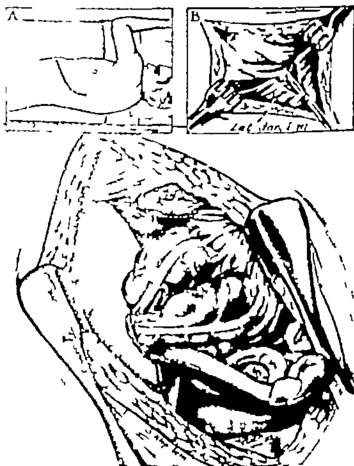


Fig. 105 —Steps in exposure of traumatic diaphragmatic hernia. (Courtesy of Lam, C. R.: Arch. Surg. 60 421-430 March 1950)

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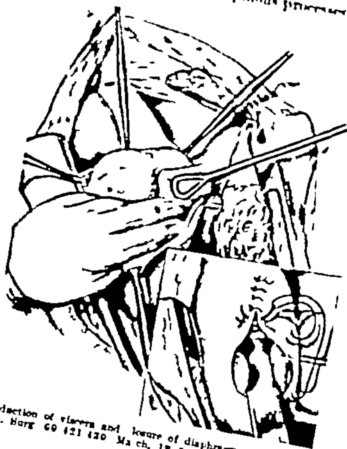


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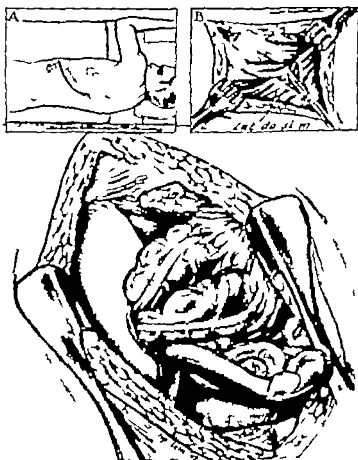


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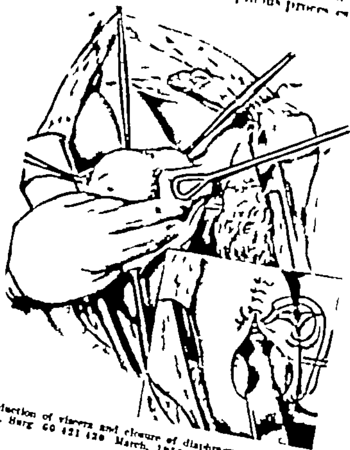


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hernias, it may be extremely difficult. The diaphragmatic defects are repaired with a one layer closure using heavy silk. When severe infection due to a perforated stomach is present, chromic surgical gut is used. The defects are sutured in the direction which allows closure with the least tension. After repair, the lung is expanded to fill the thorax if possible. This may be facilitated by releasing adhesions or *minor decortication procedures. A solution of 100,000* units of peni-

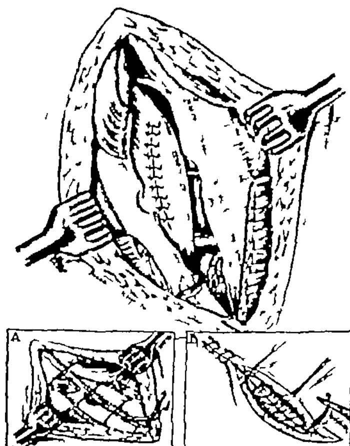


Fig. 107.—Steps in closure of thoracic wall after repair of diaphragmatic hernia. Note small autogenous intramedullary peg in transected eighth rib. Catheter is withdrawn when no more air can be removed from the chest after skin closure. (Courtesy of Lam, C. R. Arch. Surg 60 421-430 March, 1950.)

cillin in 10 cc. saline is sprayed in the chest. The cut edges of the transected eighth rib are held together by insertion of an intramedullary bone peg removed from its upper edge (Fig 107). The ribs are held together by periosteal sutures of heavy braided silk or no. 3 chromic surgical gut. A catheter is left protruding from the thoracic cavity for removal of air after skin closure. *Prophylactic doses of* penicillin are given in all cases.

Esophageal Hiatal Hernia in 110 patients is discussed by Louis H Clerf, Thomas A Shallow, F Johnson Putney and Kenneth F Frys (Jefferson Med College) Sex distribution was about equal, 78 patients were aged 50 70 Most patients had several complaints the commonest were dysphagia (62 patients) and pain (58 patients) When these symptoms are present esophageal hiatal hernia must be seriously considered Since there is no characteristic clinical picture diagnostic errors were common Cardiac, respiratory or gastrointestinal diseases may be simulated It is important to exclude cardiac disease, for it may contraindicate surgery Commonest incorrect diagnosis was carcinoma

X ray studies and esophagoscopy should both be used for diagnosis With roentgenography, the stomach and esophagus must be viewed from many angles to determine the position of the lower end of the esophagus Esophagoscopy permits anatomic demonstration of a portion of stomach above the diaphragm relaxation of the esophageal mucosa and absence of the normal "pinchcock" action of the hiatus Esophagoscopy is superior to roentgenography for demonstrating ulceration

Most patients do not require surgery Those under age 55 whose hernias are increasing in size or who have one third of the stomach above the diaphragm should be operated on. Severe and recurrent hemorrhage from chronic or recurrent ulcerations or incarceration or threatened strangulation are also indications for surgical repair When surgery is required repair of the defect is the treatment of choice, but for poor operative risks, phrenic exeresis under local anesthesia may be carried out

Medical treatment consists of a bland, low residue diet thorough mastication elimination of bulky foods, swallowing of small amounts at a time and utilization of liquids for washing down the food bolus Postural measures to encourage passage of food are advocated Sodium bicarbonate aluminum hydroxide phenobarbital and belladonna, alone or in combination, may be useful, especially with ulcerations Dilatation of obstruction by esophageal or peroral passage of olive tipped bougies over a previously swallowed

(8) J. A. M. A. 142:169 17 May 13 1950.

string afforded relief for many years in some patients Application of 10 per cent silver nitrate promotes healing of ulcerations.

[Although many of the small hernias are not associated with symptoms and are discovered accidentally the large ones almost always are associated with symptoms. Moreover if a loop of bowel is present there is great danger of strangulation. Even if only the stomach is involved there is always danger of ulceration and hemorrhage. The small ones are comparatively easy to repair and nowadays the operative risk is very slight. Is it rational, therefore, to postpone operation until the hernia is large enough to produce symptoms and to have developed dangerous complications? Should not our attitude toward these hernias be the same as toward inguinal and other hernias? Why discuss a "medical treatment" for the condition?—Ed.]

Treatment of Inguinal Hernia in Infants and Children is reported by H. Max Schiebel and W H. Freeman[9] (Durham, N C) Experience with 100 hernias in 92 patients indicates that early operative repair is simple, safe and the recurrence rate low One girl and 7 of the 80 boys had bilateral hernias Right-sided inguinal hernias were noted in 73 per cent and left-sided in the others

Symptoms were not unlike those seen in adults. Differential diagnosis includes hydroceles, inguinal lymphadenitis, undescended testis and testicular torsion There were 22 incarcerated and 10 strangulated hernias Hydrocele was associated with hernia in 11 cases Hernia incarceration and strangulation occurred more often in the first year of life, at which time the ring is small and frequent crying raises intra abdominal pressure

The wearing of a truss in this age group is troublesome and unsatisfactory The Bassini operation was used in 32 of 84 patients, the Ferguson in 23 and the Halsted in 36 Nonabsorbable suture material resulted in more comfort and greater voluntary activity Sac content included intestine in 18 omentum in 6 large bowel in 7 testis in 4 and right tube ovary and a portion of uterus in 1.

There were no deaths. In 79 patients followed an average of 3½ years there have been no recurrences, painful incisions or testicular atrophy

[In the treatment of inguinal hernia in children it is almost never necessary to resort to transplantation of the spermatic cord (Bassini operation) or other radical and extensive plastic procedures. In practically all cases, all that is necessary is the high removal of the sac above its thickened part which indicates the location of the internal ring.—Ed.]

(9) South. M. J 43 605-609 July 1950

Henry Approach to Femoral Hernia Report of two Cases with successful outcome is made by James F Musgrove (Mayo Clinic) and Frederick J McCready[1] (Mayo Found.) With the Henry technic it is possible to visualize both femoral canals to determine whether hernia is bilateral An abnormal obturator artery may be ligated under excellent exposure If ligation of the neck of the sac is carried out

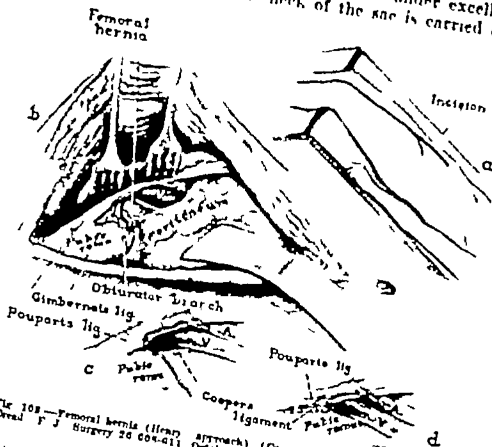


Fig 108 —Femoral hernia (Henry approach) (Courtesy of Musgrove J F and McCread F J Surgery 26 608-611 October 1949)

at its origin a peritoneal dimple is not formed as the starting point of a recurrent hernia Strangulated femoral hernia may be readily dealt with through this approach A femoral hernia may be repaired coincidentally with necessary surgical measures in the lower portion of the abdomen

METHOD —Figure 108 demonstrates the view of the femoral hernia and its related anatomic structures obtained by means of Henry's extraperitoneal approach. Optimal exposure is obtained by placing the patient in a modified Trendelenburg position A low midline in

(1) Surgery 26 608-611 October 1949

cision is made, the rectus muscles are separated and the unopened peritoneum is reflected from the lateral pelvic wall by blunt gauze dissection. The hernial sac, Gimbernat's ligament, Poupart's ligament, Cooper's ligament, the pectineal fascia and the external iliac vein are easily identified. With incarcerated femoral hernia, Gimbernat's ligament usually must be incised to relieve constriction about the neck of the sac. This may be accomplished easily without fear of injuring an anomalous obturator artery, should there be one. The femoral canal is easily repaired with the ligamentous structures and neighboring vessels in clear view Poupart's ligament is brought down and sutured to Cooper's ligament as far laterally as the external iliac vein.

Anatomy of Hernial Regions Obturator Hernia and General Considerations In dissection of about 360 body halves, Barry J Anson (Chicago), Lawrence J McCormack (Rochester, Minn.) and Henry C Cleveland[2] (New York City) found no case of serious hernia into the obturator canal but there were six instances of lipomatous protrusion of the preperitoneal layer into the canal. The findings in one adult male specimen form the basis of their report.

In the anterior portion of the lesser pelvis the peritoneum covers the superior surface of the urinary bladder and is reflected upward to the greater pelvis and abdominal wall. The preperitoneal tissue envelops all the pelvic visceral and associated blood vessels, acts as a cushion guarding the obturator canal against diverticular herniation of the overlying peritoneum and may be the source of a fatty process which comes to occupy the obturator canal. The preperitoneal tissue fuses with the visceral portion of the endopelvic fascia and is carried upward to the inguinal wall, into the iliac fossae and over the vertebral column as a definite sheet which thins as it ascends (Fig 109) In the region of the obturator canal it takes the form of a wing like prolongation of the fibrous envelope of the bladder In both the greater and the lesser pelvis this is readily removable by blunt dissection from the subjacent superior fascia of the pelvic diaphragm and the fascial covering of the obturator internus muscle (Fig 109 right side) It contains an appreciable deposit of fat and is moderately thick as it overlies the orifice of the obturator canal.

The parietal portion of the endopelvic fascia, against

(2) Surg., Gynec. & Obst. 90:31 38 January 1950

which the preperitoneal layer rests constitutes the covering of the obturator internus muscle. It is carried into the obturator canal (Fig. 109 at arrow C) and fuses with the tissue of the obturator membrane and with that of the surrounding periosteum. Externally it appears deep to the femoral muscles which arise from the body and rami of the pubis (Fig. 110, at cross).

Fig. 109.—Coronal section of pelvis of a man, viewed from behind. Section passes back of obturator canals and cut through pubococcygeal portion of levator ani, sphincteric musculature and fasciae of deep perineal compartment, and muscles in superficial perineal compartment, scrotum and testes, cavernous bodies and obturator muscles of proximal part of thigh. Peritoneum and preperitoneal tissue have been located on right to demonstrate obturator hernia (at arrow C). These layers have been removed on left (empty obturator canal indicated by arrow C). Heavy preperitoneal layer is chiefly fatty; it is relatively thin in greater pelvis but thick in lesser pelvis where it passes between external iliac vessels and urinary bladder. (Courtesy of Anson, B. J. et al.: Surg., Gynec. & Obst. 90:31, January 1950.)

The obturator membrane is a strong fibrous aponeurotic sheet which almost completely closes the obturator foramen in the innominate bone. The obturator crest on the pelvic aspect of the superior pubic ramus is a groove which is converted into a canal by the membrane. Through this obturator canal vessels and nerves of the same name pass

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The parietal portion of the endopelvic fascia, against

(3) Surg Gynec. & Obst. 90 31-38 January 1950

from the pelvis to the medial aspect of the thigh. Obviously an adjacent part of the preperitoneal layer could be pressed through the pelvic orifice of the canal (Fig 109, arrow *C*) Despite displacement of this tissue, the peritoneal layer in the region of the obturator canal remains smooth.

When the preperitoneal and peritoneal tissues are removed sharply defined margins of the inner aperture of the obturator canal are visible Superiorly, laterally and

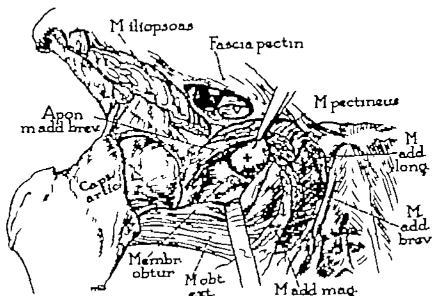


Fig 110—Same specimen as preceding. Dissection carried to level of obturator membrane and obturator canal. Capsule of hip joint has been partly removed to show relation between obturator structures and head of femur Pectineus and adductor longus have been cut close to their origins. Adductor brevis muscle and its aponeurosis have been retracted cranialward with underlying hernial protrusion (at cross) Obturator externus has been freed from obturator membrane and retracted caudalward. It is thereby demonstrated that origin of adductor brevis extends lateralward to fuse with capsule of hip joint and that, in being thus prolonged, it normally covers external aperture of obturator canal (latter here occupied by hernial mass) (Courtesy of Anson, B. J., *et al.* Surg., Gynec. & Obst. 90:31 36 January 1950.)

inferolaterally the bony limits of the inner orifice are the walls of the obturator on the inferior aspect of the superior ramus of the pubic bone Medially and inferomedially the margin of aperture is formed by the strong obturator membrane. The orifice leads into the obturator canal, a cylindric passageway 2 cm. long The small channel through which an obturator hernia gains exit from the pelvis lies beneath the pectineus muscle which is superficial to the adductor brevis and obturator externus. These muscles are held in

patients dying after operation was 67 years, compared to 45 years for the whole series.

Ferguson concludes that every inguinal and femoral region should be thoroughly explored when operation for hernia is done on patients over 35, regardless of the type of hernia diagnosed preoperatively Excellent results can be obtained by practiced surgeons using the standard types of operation. About 10 per cent of patients with a single hernia may expect to develop a contralateral hernia. Length of follow up period, even up to 20 years has an important bearing on over all recurrence rates and on the apparent percentage of recurrences that take place early All patients operated on for hernia should be persuaded to report regularly for follow up examinations.

STOMACH—DUODENUM

Pathologic Physiology

Determination of Gastric Acidity without Intubation by Use of Cation Exchange Indicator Compounds Harry L Segal, Leon L. Miller and John J Morton[4] (Univ of Rochester) prepared quininium resin indicator compounds from the cation exchange resin Amberlite IRC-50 or Amberlite XE-96 conditioned in the acid form. The resin was allowed to react with an aqueous solution of quinine hydrochloride so that 1 Gm. resin took up the quinine cations present in 20 mg quinine hydrochloride In vitro tests demonstrated that the quininium cation in this compound is displaced by hydrogen ions of dilute hydrochloric acid solutions and of gastric juice

In vivo experiments were performed by administering the resin indicator in 2 Gm. doses with 50 cc of 7 per cent alcohol. Urine was collected before and one two and three hours after administration of the indicator compounds. From each sample quinine was extracted by the ether sulfuric acid technic of Kelsey and Geiling In 34 of 38 patients with free gastric hydrochloric acid, quinine was

(4) Proc. Soc. Exper Biol. & Med. 74:218 220 May 1950

found in the urine excreted in the first second and third hours after administration of the compound None of 25 achlorhydric patients showed quinine in the first hour of urine excretion and 20 failed to excrete it in the second hour

By this method presence or absence of free hydrochloric acid in gastric juice can be determined without intubation Quininium cations in the urine during the first two hours after administration of the indicator denote the presence of free hydrochloric acid If they do not appear until the third hour after administration no free hydrochloric acid is present If the cation is not excreted in the first hour but appears in the second hour quantitative photofluorometric examination of urine extracts must be carried out to determine whether free gastric hydrochloric acid is present

Secretory Studies on Isolated Stomach. Lester R Dragstedt, Edward R Woodward William B Neal Jr., Paul V Harper Jr., and Edward H Storer[5] (Univ of Chicago) conclude from their experiments that total isolation of the stomach in dogs, with preservation of blood and vagus nerve supply permits the quantitative collection of gastric secretion for weeks or months Such stomachs may secrete a maximal average of 906 973 cc gastric juice in 24 hours when the alimentary tract is reconstructed by anastomosis of the esophagus with the side of the jejunum or the end of the duodenum When the fundus alone is isolated and the esophagus united with the gastric antrum, a maximal average of 1 687 cc gastric juice in 24 hours may be obtained, which indicates the stimulating effect of the antrum on gastric secretion when it comes into contact with the ingested food.

Continued secretion and loss of these large amounts of gastric juice cause progressive hypochloremia, alkalosis, dehydration, azotemia and death in 4 12 days, when the only salt supplied is that present in the stock diet. These chemical changes in the blood can be prevented and life preserved for long periods by intravenous injection of 1,000-2,000 cc isotonic NaCl solution or the addition of

(5) Arch. Surg. 60 1 20 January 1950

patients dying after operation was 67 years, compared to 45 years for the whole series.

Ferguson concludes that every inguinal and femoral region should be thoroughly explored when operation for hernia is done on patients over 35, regardless of the type of hernia diagnosed preoperatively. Excellent results can be obtained by practiced surgeons using the standard types of operation. About 10 per cent of patients with a single hernia may expect to develop a contralateral hernia. Length of follow-up period, even up to 20 years, has an important bearing on over-all recurrence rates and on the apparent percentage of recurrences that take place early. All patients operated on for hernia should be persuaded to report regularly for follow-up examinations.

STOMACH—DUODENUM

Pathologic Physiology

Determination of Gastric Acidity without Intubation by Use of Cation Exchange Indicator Compounds. Harry L. Segal, Leon L. Miller and John J. Morton[4] (Univ. of Rochester) prepared quininium resin indicator compounds from the cation exchange resin Amberlite IRC-50 or Amberlite XE-96 conditioned in the acid form. The resin was allowed to react with an aqueous solution of quinine hydrochloride so that 1 Gm. resin took up the quinine cations present in 20 mg. quinine hydrochloride. In vitro tests demonstrated that the quininium cation in this compound is displaced by hydrogen ions of dilute hydrochloric acid solutions and of gastric juice.

In vivo experiments were performed by administering the resin indicator in 2 Gm. doses with 50 cc. of 7 per cent alcohol. *Urine was collected before and one, two and three* hours after administration of the indicator compounds. From each sample quinine was extracted by the ether-sulfuric acid technic of Kelsey and Geiling. In 34 of 36 patients with free gastric hydrochloric acid, quinine was

(4) Proc. Soc. Exper. Biol. & Med. 74: 218-220, May, 1950.

found in the urine excreted in the first, second and third hours after administration of the compound. None of 25 achlorhydric patients showed quinine in the first hour of urine excretion and 20 failed to excrete it in the second hour.

By this method presence or absence of free hydrochloric acid in gastric juice can be determined without intubation. Quininium cations in the urine during the first two hours after administration of the indicator denote the presence of free hydrochloric acid. If they do not appear until the third hour after administration no free hydrochloric acid is present. If the cation is not excreted in the first hour but appears in the second hour, quantitative photofluorometric examination of urine extracts must be carried out to determine whether free gastric hydrochloric acid is present.

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Continued secretion and loss of these large amounts of gastric juice cause progressive hypochloremia, alkalosis, dehydration, azotemia and death in 4-12 days when the only salt supplied is that present in the stock diet. These chemical changes in the blood can be prevented and life preserved for long periods by intravenous injection of 1,000-2,000 cc. isotonic NaCl solution or the addition of

(8) Arch. Surg. 60:1-20, January, 1950.

10-15 Gm NaCl to the diet daily Cessation of salt replacement even after five or six months results in prompt demineralization dehydration and death

The development of hypochloremia alkalosis and dehydration produces prompt and striking reduction in the volume of gastric juice secreted in 24 hours and also a reduced concentration of hydrochloric acid in the parietal secretion. With this depressed secretion, intravenous injection of salt solution or administration of sodium chloride by mouth causes a considerable increase in the volume and acidity of gastric juice

When adequate salt replacement is carried out and dehydration prevented volume and acidity of the gastric secretion are but slightly reduced by fasting for 24 or 48 hours. This is in decided contrast to the great reduction in gastric secretion produced by fasting in Pavlov pouch dogs or in animals with vagally denervated total pouches.

Progressive typical peptic ulcers regularly appear in the vagally innervated isolated stomach in from one week to several months and cause death from hemorrhage or perforation Such ulcers also occur in large actively secreting Pavlov pouches but have not been seen in similar preparations in which the vagus nerves have been divided. The occurrence and progression of the ulcers can be observed by means of a cystoscope introduced through the cannula into the isolated stomach.

Effect of Vagotomy and Antrum Resection on Mann Williamson Ulcer was studied by E. H Storer, E R. Woodward and L R Dragstedt[6] (Univ of Chicago) In 11 dogs bilateral division of the vagus nerve was performed by transthoracic approach, followed in four to six weeks by the Mann Williamson procedure Typical Mann Williamson ulcers developed in controls and average survival time was 68 days Ulcers developed in about 45 per cent of animals with vagus section, survival time being essentially the same *as for the controls The gastric antrum comprising* about one fourth of the stomach, was resected in six animals and the fundus anastomosed to the distal segment of jejunum in completing the Mann Williamson procedure Complete

(6) Surgery 27 525-530 April, 1950

protection from experimental ulcer was afforded two thirds of the animals The Mann Williamson procedure plus antrum resection and vagus section was performed in six dogs with complete protection from experimental ulcer in 83 per cent

The incidence of recurring jejunal ulcer after antrum resection in duodenal ulcer in man is not as high as the incidence of Mann Williamson ulcers in dogs with previous antrum resection This may be due to the fact that in experimental ulcer the duodenal secretions are deviated completely into the lower intestine whereas in most stoma ulcers in man the secretions pass over the ulcer area In man most duodenal and stoma ulcers are due to gastric hypersecretion Complete absence of the automatic neutralizing effect of duodenal secretions rarely plays a role in the clinical problem Absence of gastric hypersecretion may explain why jejunal ulcers do not occur after gastroenterostomy in normal dogs or in man with gastric carcinoma or ulcer associated with normal or depressed secretion The Mann Williamson operation offers too severe a test for the efficacy of therapeutic measures proposed for man

Effect of Gastrectomy and Diversion of Duodenal Secretions into Terminal Portion of Ileum on Development of Ulcer James V Oliver[7] (Univ of Illinois) reports results of two series of experiments on dogs In the first series of 10 animals three fourths of the stomach was extirpated and continuity of the alimentary tract restored by end-to-side gastrojejunostomy followed by diversion of the duodenal secretions (including bile and pancreatic juice) into the terminal portion of the ileum Autopsy on the four surviving over 30 days (average 52 days) showed stomal ulcer In two the ulcer had perforated

These observations were compared with those on the eight in the second series which survived 30 or more days after a two stage operation total gastrectomy with anastomosis of the cardia to the jejunum followed by shunting of the duodenal secretions into the terminal portion of the ileum In none did a jejunal or stomal ulcer develop nor did

(7) Arch Surg 59 199 09 August 1949

autopsy show any suggestion of a healed stomal ulcer Six animals died 44 51, 87 120, 134 and 195 days after the second operation, and the other two were killed after 223 days. Average survival was 125 days (including the two animals that were killed) All presented varying degrees of jejunitis, and the tissues appeared extremely anemic Weight loss averaged 45 per cent of the preoperative body weight. With care, the animals of this series probably could have lived indefinitely, but no particular attention was paid to their nutrition except for modification of the stock diet

Oliver concludes that presence of gastric secretion is the important factor in development of ulcer after a Mann Williamson operation because no ulcer will develop if at least 98 per cent of the stomach is removed.

Peptic Ulcer

Chronic Duodenal Ulcer with Reference to Hormonal Influences and Surgical Treatment F A. B Sheppard[8] (Winnipeg) states that surgical treatment is indicated when the ulcer becomes complicated by acute perforation, severe or recurrent hemorrhage, chronic penetration or stenosis, or in other words when it fails to respond to medical treatment. Unfortunately medical treatment is too often prolonged until the ulcer has invaded a neighboring organ. The uncertainty which often exists in management of this disease results largely from confusion as to its etiology and partly from lack of full appreciation of the pathology Sheppard believes that the abnormal acid secretion in the stomach is an expression of hormonal rather than vagal overaction and that the disordered hormonal action is possibly a response to mucosal ulceration rather than an initial cause the duodenal ulceration acts as the stimulus to continued gastric secretion which, by its irritating effect, aggravates the ulceration and thus sets up a vicious circle The pathology of ulcer is such that, if the process is not soon brought under control, extension beyond the duodenum occurs, and this is the most likely reason for failure of conservative care

In 80 per cent of cases the duodenal ulcer is situated

(8) Canad. M. A. J 61:280-285 September 1949

on the posterior wall and surgery must be instituted before complications arise. Proper surgical therapy may be expected to relieve completely 60 per cent of patients and to relieve almost completely another 35 per cent, 5 per cent will continue dissatisfied but except for the occasional instance of gastrojejunal ulceration, will not be worse off than before operation. Gastrojejunostomy is advised in cicatricial pyloric stenosis. Vagotomy may be performed for ulcer and hemorrhage occurring after gastrojejunostomy or subtotal gastrectomy and as an aid in gastrojejunostomy. High subtotal gastrectomy is the operation of choice.

This opinion is based on the results obtained in 1,083 operations in which two principles were followed: resection through the duodenum beyond the ulcer, and resection through the stomach at a constant high level, the lesser curvature being cut just below the esophageal opening and the greater curvature at the second lowest of the short gastric arteries. A two stage gastrectomy may be desirable in certain cases when the ulcer appears irremovable.

In the 1,083 resections in 14 years there were 32 deaths (under 3 per cent); in the first 226 cases completed at the end of 1937 there were 13 deaths and in the remaining 857 cases 19. Operative mortality would be less than 1 per cent if failure of an ulcer to heal or development of incurable complications, despite adequate medical care, were more readily acknowledged or recognized.

Peptic Ulcer Following Splanchnicectomy was observed by Stephen C. Mason and H. M. Pollard[9] (Univ. of Michigan) in 13 of 1,498 patients who underwent bilateral splanchnicectomy and lower dorsal ganglionectomy at University Hospital from June 1934 to June 1945. Preoperatively 3 of the 13 patients had a proved diagnosis of peptic ulcer and 4 a presumptive diagnosis and 3 had suggestive symptoms. Postoperatively ulcer was proved in nine patients and a presumptive diagnosis was reached in three. In the remaining patient symptoms suggested ulcer, but it was not known whether the duodenal deformity seen six years postoperatively represented scarring that occurred before or after splanchnicectomy.

(9) Surg. Gynec. & Obst. 89: 271-274, September 1949.

About 2.5 per cent of the 1,498 patients were considered to have a definite preoperative history of peptic ulcer, and 21 per cent of these reported a recurrence after operation.

Preoperatively, four patients had hemorrhage of no great severity By contrast, 11 of the 12 ulcers which appeared after splanchnicectomy were complicated. It was often only by this complication that the ulcer announced its presence Five of these patients had severe complications two were fatal and three required emergency laparotomy one for closure of a perforation, the other two to ligate arterial bleeders in the base of the ulcer Of the last two patients one had an active ulcer at the time of splanchnicectomy and the other probably had one

It seems clear that frequent and severe complications of ulcer developed in these patients because the normal epigastric pain sensations were abolished or greatly reduced so that the ulcers were permitted to advance to dangerous proportions without giving the usual warning Whether the splanchnicectomy itself caused the ulcers cannot be concluded from the findings however in four patients the first ulcer developed postoperatively and two of these resulted in fatal hemorrhage The patients with the longest history of ulcer before operation usually had the more serious complications. In patients with recently healed ulcer and especially those with active ulcer complications developed most rapidly after operation and the complications were the most severe observed.

Epigastric pain was present immediately after splanchnicectomy in two patients and in both severe complications finally developed. Vague epigastric distress months to years postoperatively was noted by five of the eight patients in whom abdominal symptomatology was mentioned Severe pain was described by three and appeared as the ulcer was penetrating or perforating More attention should be paid to vague abdominal signs and symptoms after splanchnicectomy Prompt diagnosis and rigid medical management would reduce the frequency of complication when peptic ulcer is present.

Serum Enzyme Changes in Perforated Peptic Ulcer Henry Wapshaw[1] (Glasgow) was led into making this investiga

(1) Lancet 2:414-416 Sept. 3 1949

tion by discovery of a case of perforation in which the serum diastase and lipase readings were so high and the symptoms and signs so obscure that an erroneous diagnosis of acute pancreatitis was made In 30 cases of perforated peptic ulcer situated anteriorly and unrelated to the pancreas he studied the diastatic activity of the blood by the iodometric technic of Somogyi and the serum lipolytic activity by the Loewnhardt method as modified by Cherry and Crandall All patients but the one already referred to were operated on and the perforations closed The cases seemed to fall naturally into three groups 13 studied during the first six hours 15 studied between the seventh and twelfth hours and 3 seen later For patients in the first group the chemical findings lay within the normal limits for both tests Among patients of the second group coming under observation during the critical phase of the illness, four had slightly raised diastase readings, and two of these also had raised lipase titers In the third group one patient gave normal enzyme readings, whereas the values were substantially elevated for the remaining two with perforation of 15 hours and of 2 days standing

The significance of these results can only be appreciated by comparing them with those in cases of acute pancreatitis in which the increase in digestive activity of the blood is greatest during the first few hours and the readings thereafter show a steady decline until normal levels are reached between the third and seventh days It seems reasonable to infer that peritonitis, which usually sets in about the seventh hour and caused death in the three late cases, may have been the damaging factor But further study of this side effect of perforated peptic ulcer is needed before definite conclusions can be drawn as to its cause and frequency

Perforated Peptic Ulcer Assessment of Value of Non operative Treatment in 20 patients as compared with operative treatment in 37 was made by B McN Truscott and J F R Withycombe[2] (Cambridge) The mortality in the conservatively treated group was 15 per cent, in the operated group 5 4 per cent

Medical treatment avoids the physical and mental upsets

(2) Lancet 1 894-896 May 13 1950

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(2) Lancet 1 894 896 May 13 1950

of operation and enhances the patient's comfort. There is greater freedom from intra abdominal adhesions. It is of special value when a patient is a bad operative risk or when medical signs indefinitely indicate or mimic perforation. Conservative treatment may decrease hospitalization somewhat. It is also of value when good surgical facilities are not immediately available

However, the lower mortality accompanying surgery is significant. The gravest objection to conservative methods is the possibility of mistaken diagnosis. Furthermore when bad results follow conservative treatment, there may be some uneasiness that the patient was not given the best possible therapy The treatment of choice for most perforated ulcers is immediate laparotomy and closure of perforation.

Perforation and Hematemesis Louis A. Ives[3] (London) states that this combination is rare When it occurs, the cause is either a single ulcer which has grown so large as to involve both anterior and posterior aspects of the stomach or duodenum or the presence of multiple lesions. The general belief that the syndrome has a high mortality is supported by the meager statistics available.

When perforation follows hematemesis, the necessity for operation is evident The choice of operation lies between simple closure of the perforation and partial gastrectomy Though immediate resection is the ideal operation, circumstances may suggest the lesser procedure because many perforations are dealt with in the small hours when a skilled team is usually unavailable If continuing hemorrhage does not respond to transfusion, a planned resection may be carried out since the operative risks are outweighed by the dangers of further delay Ives has been unable to find any reports supporting immediate gastrectomy for this sequence.

In contrast, postoperative hemorrhage affords an opportunity for deliberate consideration of the advisability of further operation, though undue procrastination may prove fatal. That early gastrectomy is the operation of choice is shown by the author's three cases two patients treated by

(3) Lancet 1 4(4 Feb 11 1950

this method had a smooth and uneventful recovery, whereas the third, who received transfusions equivalent to nearly five times his circulating blood volume, deteriorated slowly and progressively until his death

Surgical Considerations in Hemorrhage of Upper Part of Gastrointestinal Tract. W E Sullens, F Steigman and K. A. Meyer[4] (Cook County Hosp) studied 305 patients with gross melena, hematemesis or both from various causes, as shown in the table. In 40 per cent the initial red cell count was below 2,500,000, and 26 per cent had fainted as a result of the bleeding Men comprised 83 5 per cent of those with peptic ulcer and 78 7 per cent of those without ulcers The patients without ulcer had a somewhat higher average age.

In diagnosing peptic ulcer as the cause of bleeding the past history is important. There was no previous indication of peptic ulcer in 17 6 per cent of the 230 ulcer patients X rays made after a barium meal, available in 124 cases, showed ulcer in 54 per cent. Gastroscopy is a valuable aid in determining the bleeding site In 30 patients with peptic ulcer gastroscopy was performed, and an ulcer was demonstrated in 8 In four of the eight the ulcer had escaped detection by x rays made after a barium meal. In two patients gastroscopy gave negative results, but x rays revealed gastric ulcer Diagnosis of gastritis in absence of gastroscopy is not definite. Portal cirrhosis with bleeding from esophageal varices was usually diagnosed clinically on the basis of signs of advanced disease of the liver The rarer causes of bleeding in this series illustrate the importance of careful examination and laboratory study of patients with hematemesis or melena.

Mortality associated with the various causes of bleeding in the series is shown in the table A factor significantly influencing the mortality rate was age In patients over 60 with peptic ulcer mortality was 38 1 per cent. Symptoms such as fainting, pain in the back and diarrhea seem to be associated with an increased mortality, but the relation between number of previous hemorrhages and mortality was not striking Mortality was greater when systolic blood

(4) Arch. Surg. 59:1244 1 60 December 1949

pressure on admission was below 100 than when it was above this level. Prognosis for those who continued to bleed or had recurrent bleeding after 48 hours medical treatment was poor

Intensive medical management must be started on every patient with massive bleeding from the upper gastrointestinal tract It should consist of absolute bed rest, sedation, blood transfusions and administration of other fluids to restore the electrolyte balance and to combat dehydration and azotemia Vitamins and antispasmodics may be given

ETIOLOGIC FACTORS IN BLEEDING OF UPPER PART OF GASTROINTESTINAL TRACT

DIAGNOSIS	CASES	%	MORTALITY %
Peptic ulcers, total	230	75.6	12.2
Duodenal	63		
Gastric	30		
Marginal	11		
Gastric and duodenal	5		
Site not recorded	121		
Portal cirrhosis of liver	30	9.8	63.3
Acute gastritis	16	5.1	5.0
Carcinoma of stomach	15	4 9	60.0
Miscellaneous	7	2.3	71.4
Polyp of stomach	1		
Carcinoma of duodenum	1 (died)		
Primary carcinoma of liver with portal vein thrombosis	1 (died)		
Thrombocytopenic purpura	1 (died)		
Banti's syndrome	1 (died)		
Syphilitic cirrhosis of liver	1 (died)		
Diverticulum of duodenum	1		
Diagnosis undetermined	7	2.3	

parenterally Shortly after vomiting ceases antiacids may be given with hourly milk and cream feedings. Blood transfusions are the basis for successful treatment, and though the amount of blood given should be governed by the patient's need, he should be watched for symptoms and signs indicating overburdening of the cardiovascular system If blood is given at the rate of about 4 cc /minute there is little need to fear further bleeding due to a rise in blood pressure Surgery must be seriously considered if active bleeding continues despite intensive medical management. It should not be delayed until the patient becomes too poor a surgical risk Gastric resection is the operation of choice

but if the patient is in poor condition less extensive procedures may be substituted

An early decision regarding surgery should be made since in this series 50 per cent of the fatalities occurred in the first three days of hospitalization The mortality among 204 patients with bleeding peptic ulcer treated medically was 11.3 per cent An emergency operation was performed on 10 patients during active bleeding, of whom 5 died Operation was performed on 16 after initial bleeding had ceased and none died It is important that the surgically treated had much more severe and intractable conditions than did the medically treated patients. Of the latter, only 7 per cent had bleeding after 48 hours' treatment, whereas in the former group 58 per cent continued to bleed or had recurrent bleeding after 48 hours medical treatment.

Treatment of Severe Bleeding from Peptic Ulcer Cranston W Holman[5] states that with the conservative therapy used in 1932-39 at New York Hospital, mortality was 13 + per cent in 161 patients. Although most patients responded to conservative measures mortality was over 50 per cent in two types of patients (1) those who continued to bleed for 24-48 hours after they had been placed on a strict medical regimen and (2) those who started to bleed in the hospital while under strict medical treatment for a previously uncomplicated ulcer Therefore, since 1940 it has been the policy to perform immediate operation on these two types of patients Using surgery, the mortality was reduced to 5 + per cent in 257 patients.

Once operation is decided on the sooner it is undertaken the better Preliminary steps include placing the patient in a fully equipped hospital, early consultation between physician and surgeon, and immediate arrangement for giving transfusions and withholding everything by mouth during the first few hours of observation. After the patient is accustomed to his new surroundings, the decision whether a restricted diet is to be given should be determined by whether the patient is hungry Hunger pains indicate motility of the stomach, which can be reduced or eliminated by feeding If patients are nauseated or do not wish to eat,

(5) Surg. Clin. North America 30 421-427 April, 1950

food may initiate vomiting and contribute to recurrence of bleeding

Gastric resection is the procedure of choice Although it may seem a formidable operation in a person debilitated by blood loss, it is surprisingly well tolerated. In the large, penetrating callous ulcer of the posterior duodenal wall,

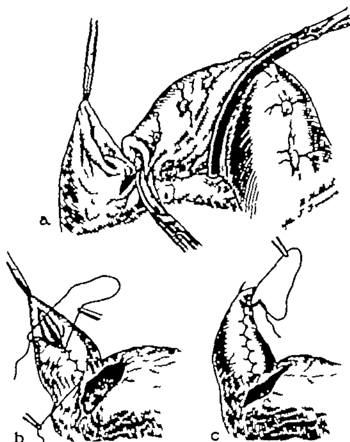


Fig. 111 —Judin's "en escargot" technic for bleeding peptic ulcers. Operative steps in freeing the first part of the duodenum from the base of the penetrating ulcer and its conversion into a conical form. (Courtesy of Holman, C. W Surg. Clin. North America 30:421-427 April, 1950 modified from Gordon-Taylor G Brit. J Surg. 33 342.)

closure of the duodenal stump may be difficult. At times it can be accomplished best "en escargot" (in the form of a snail), as recommended by Judin (Figs. 111 and 112) This method requires complete mobilization of the anterior lateral wall of the duodenum for 4-6 cm distal to the ulcer, so that a complete tampon of the ulcer crater by the mo-

bilized duodenum is accomplished without tension On rare occasions, because of a patient's poor condition, ligation of the vessels leading to the ulcer may be substituted for re section, but indirect methods such as gastroenterostomy and plaster procedures on the duodenum are of little value

Bleeding from a marginal ulcer secondary to gastric re

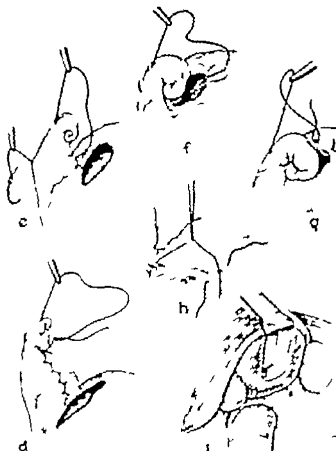


Fig 133—Judin's "en escargot" technic continued. Conversion of cone into a snail-like form and its use to tampon ulcer base. (Courtesy of Holman, C. W: Surg. Clin. North America 30 421-427 April, 1950; modified from Gordon-Taylor, G.: Brit. J Surg. 33.343)

section or gastroenterostomy is not as serious as that from a primary ulcer, probably because the secondary ulcer often occurs in the jejunal side of the anastomosis in which vessels are relatively small. The simultaneous or immediately successive complications of perforation and hemorrhage are particularly serious and are best treated by gastric resection.

About 87 per cent of patients recover from bleeding under a conservative regimen but over 50 per cent of these will bleed again and 75 per cent will have symptoms requiring medical attention. These are potent arguments for surgery particularly in patients over age 40

Bleeding Peptic Ulcer Among 2,400 patients with gastric, duodenal or marginal ulcer admitted to Johns Hopkins Hospital between 1928 and 1946 Edward F Lewison[6] found that 218 had active hemorrhage from ulcer From the annual rate of admissions it could not be concluded that the mental and physical strain of World War II predisposed ulcer patients to increased hemorrhage The discomfort of peptic ulcer is less prevalent in the summer, and during this season there is a lowered incidence of hemorrhage.

In the 218 with hemorrhage the proportion of males to females was 5.2 1 however of the 16 patients who died 15 were males The ratio of whites to Negroes was 2 3 1. Mortality in patients under 50 was 5 3 per cent, and in those over 50 1 8 per cent. However half of the former group died while in their thirties The highest mortality occurred in patients with massive hemorrhage

Often simple cases of hemorrhage may be sifted from severe cases by estimating the increase in blood urea. Massive hemorrhage into the gastrointestinal tract causes an increase of blood urea occasionally to uremic levels. The azotemia is probably due to the combined effects of reduced blood volume, lowered blood pressure, dehydration associated with hemorrhage from ulcer and the added waste products from the breakdown of blood.

The impression that severe or intractable pain is an ominous sign was not confirmed Over 75 per cent of the patients had a characteristic clinical syndrome of chronic ulcer The belief that mortality increases with each recurring hemorrhage was not verified, nor was the belief that no patient ever dies of his first hemorrhage from ulcer Pyloric obstruction causes no significant increase in death rate, but serious hemorrhage producing severe anemia, and also arteriosclerosis, noted in the record of 53 patients seemed to have a profound effect on the mortality rate

(6) Arch. Surg. 59 27 56 July 1949

Morphine was used most frequently to induce quiet and relieve anxiety Atropine sulfate given generously with morphine enhances inhibition of gastric secretion and reduces the amount of free acid Liberal use of milder sedatives e g., barbiturates, often allays anxiety and restlessness

Before 1934, the routine was to use a program of starvation. The Meulengracht method of prompt and frequent feedings now seems to be the rule Of 11 patients on a prolonged and strict program of starvation, 6 died (54 per cent) Of 76 on a modified Meulengracht diet, none died Aluminum hydroxide has been the recent antacid of choice

Surgical treatment has consisted for the most part of conservative management during active bleeding Partial gastric resection was the choice in 56 of 82 patients operated on Early operation during hemorrhage was seldom performed operation later when bleeding had ceased or at least decreased, was performed in 82 per cent In only 40 per cent of the operative cases was the source of bleeding actually removed surgically In most of these, surgery was delayed until bleeding had stopped spontaneously Hemorrhage recurred about as often as not after gastric operation and the type of operation seemed to have little bearing on recurrence rate

Seven patients had vagotomy in addition to some ancillary operation on the stomach, and after six months of careful follow up none had had recurrent hemorrhage due to ulcer

Surgical Treatment

Some Limitations of Vagotomy in Treatment of Peptic Ulcer Critical Follow up Analysis of 50 Cases Martin J Healy, Jr and Paul K. Sauer[7] (Veterans' Admin. Hosp., Bronx, N Y) studied 41 patients with duodenal ulcer and 9 with marginal gastrojejunal ulcerations All had intractable ulcer pain, and 64 per cent also had had one or more episodes of gastrointestinal bleeding In each patient the vagus nerve trunks were isolated and transected and a segment was removed for histologic verification.

All but two had complete or nearly complete relief from

(7) Ann. Surg. 130 988-1007 December 1949

ulcer pain in the immediate postoperative period. The 12 hour overnight secretion, which averaged 970 cc., was reduced to 290 cc, and maximal free hydrochloric acid values dropped from 44 to 23 units Insulin hypoglycemia tests indicated adequate section of the vagus nerves in 82 per cent. Soon after operation 80 per cent of the patients complained of varying degrees of epigastric fulness, belching, pyrosis, regurgitation and vomiting

Follow up on all patients averaged 18 months, and 94 per cent were hospitalized for careful evaluation and laboratory examinations Symptomatically, 18 per cent had excellent results, 36 per cent good and 12 per cent fair Failure occurred in 34 per cent. In 10 per cent, it occurred in the early postoperative period because of severe atonia which required further surgery In the other 24 per cent preoperative symptoms recurred Although most patients regained tonus, 36 per cent had definite atony with six hour gastric retention for 7 27 months postoperatively X rays disclosed an inactive ulcer in 42 per cent and an active ulcer in 38 per cent.

These observations do not confirm the encouraging reports of other investigators with regard to the effectiveness of vagotomy in treating duodenal and marginal ulcer The significantly large percentage of unsatisfactory results indicates that the procedure has serious limitations in treatment of peptic ulcer

Correlation of Insulin Test Studies and Clinical Results in Series of Peptic Ulcer Cases Treated by Vagotomy was made by Vernon A. Weinstein Franklin Hollander, Frances U Lauber and Ralph Colp[8] (Mount Sinai Hosp., New York City) Pre and postoperatively insulin tests were done on 125 patients treated by vagotomy alone, vagotomy and gastroenterostomy or vagotomy and subtotal gastrectomy Insulin response was negative in 29 per cent, positive in 29 per cent and equivocal in 3 per cent, achlorhydria was noted in 39 per cent. Three months after operation responses were positive in five patients who had had negative responses two weeks postoperatively No patient who originally had a positive response later had a negative

(8) Gastroenterology 14 214 227 February 1950

Of 20 patients who had vagotomy alone for uncomplicated ulcer, insulin response postoperatively was negative in 12 and positive in 8 In both groups 75 per cent of the ulcers healed and 25 per cent recurred or failed to heal. Gastric atony and diarrhea occurred in each group There was a larger percentage of atony in the partial vagotomy group, indicating that vagotomy need not be complete to produce motor disturbances

The insulin test cannot be used to prognosticate clinical results of vagotomy A positive test indicates existence of some functioning fibers between the central nervous system and stomach A negative test is suggestive of their absence but is not conclusive False negative tests may be obtained if (1) stimulus is not adequate, (2) gastric mucosa is temporarily refractory (3) there is operative trauma without actual anatomic division of the nerves, or (4) the divided nerves are regenerated In absence of free hydrochloric acid no statement can be made on the completeness of vagotomy on the basis of the insulin test Failure to attain complete interruption of secretory function by vagotomy may be largely due to the varied anatomic distribution of the nerve fibers The possible existence of nonvagal pathways over which cholinergic impulses are carried to the gastric mucosa must also be considered

Vagotomy and Partial Pylorectomy New Procedure for Duodenal Ulcer A. Davis Beattie[9] (Leicester Gen'l Hosp) states that the bar to the universal adoption of vagotomy has been the unpleasant retention phenomena which so often follow it, owing to pylorospasm He has solved this problem by a combined partial pylorectomy and pyloroplasty

TECHNIC.—After completion of vagotomy the duodenum is mobilized sufficiently for pylorectomy Stay sutures, passed through the upper and lower borders of the pylorus, serve as retractors while also minimizing hemorrhage by controlling the main pyloric vessels. The abdominal cavity is packed off and the pyloric sphincter divided. A diamond-shaped segment of the stomach and duodenum with the whole anterior portion of the pyloric ring is removed with scissors. As much as possible of the scar tissue, together with any anterior ulcer, is excised during this maneuver (Fig 113) Closure of the gap (Fig 114) is by two continuous intestinal sutures the first, with 00 catgut, unites the whole thickness of the duodenum to the gastric

(9) Lancet 1 528-530 Mar 25 1950

mucosa the second, with no 1 silk, again picks up the whole thickness of the duodenum and joins it to the muscular and peritoneal layers of the stomach. The suture line is covered with a free omental graft secured in place at each end by the stay sutures.

No special postoperative care is necessary in most cases beyond the usual respiratory exercises Ileus of the stomach

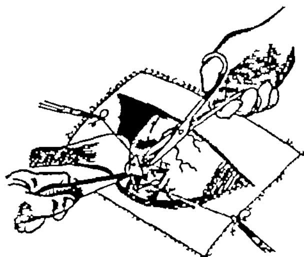


Fig. 113 —Partial pylorectomy (Courtesy of Beattie A D : Lancet 1 525-530 Mar 25 1950)

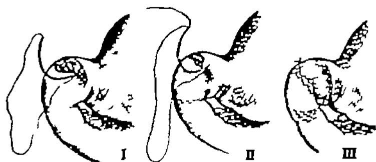


Fig 114 —Closure of duodenum. (Courtesy of Beattie A. D Lancet I 525 530 Mar, 25 1950)

and small bowel always occurs and lasts 24-48 hours the intestinal movements then gradually return. A light Meulengracht type of diet is started 12 hours after operation and rapidly increased so that full normal diet is taken on the tenth postoperative day Most patients get up after 48 hours. The only unpleasant sequela during early convalescence is

temporary dysphagia in over half the cases There have been two deaths in 210 operations both due to leakage from the suture line, probably owing to use of faulty catgut

Recurrence of Gastric Ulcer after Complete Vagotomy is reported by Lester R Dragstedt, Edward H Camp and James M Fritz[1] (Univ of Chicago) in 5 of 17 patients treated by this method alone Patients with duodenal ulcer or coexisting duodenal and gastric ulcers have a greatly increased amount of hydrochloric acid in the nocturnal fasting secretions of the stomach however in patients with gastric ulcers it is the same or less than that in normal persons This suggests that gastric ulcers are not due to increased corrosive properties of the gastric content but to decreased resistance of the gastric wall Since hypersecretion of neurogenic origin is not present with gastric ulcer, vagotomy is not indicated Subtotal gastrectomy is recommended because it is better treatment if a lesion proves to be cancerous For juxtaesophageal ulcers, vagotomy and gastroenterostomy may be performed If cancer is not proved, total gastrectomy is not warranted and subtotal gastrectomy does not remove the lesion with sufficient margin if the disease is cancerous

Results of Classic Operations for Duodenal Ulcer Five-10 Year Follow up in 532 Cases is reported by Howard K. Gray (Mayo Clinic) and Russell R Williams, Jr[2] (Mayo Found) Posterior Polya gastric resection including the ulcer was performed in 51 patients 3 died in the hospital and complete relief was obtained in 83 per cent. Posterior Polya resection excluding the ulcer was performed in 165 8 died in the hospital and 77 per cent were completely relieved Anterior Polya gastric resection excluding the ulcer was performed in seven with no deaths and complete relief in 85 per cent Posterior gastroenterostomy was done in 288 patients with 3 deaths and complete relief in 72 per cent Pyloroplasty was done in 17 patients with no deaths and complete relief in 30 per cent The Devine exclusion operation was done in four patients, without a death and with complete relief in 75 per cent.

The pronounced improvement by clinicians in conserva

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(1) Ann. Surg. 130:843-854 October 1949
(2) J. A. M. A. 140 809 818 Oct. 22 1949

tive treatment of patients with duodenal ulcer has reduced the number for whom surgery is the only possibility, automatically, the surgeon faces a complicated problem in practically every case The patients in this series were operated on between 1937 and 1941, when the trend was toward more radical therapy because of the high incidence of ulceration near gastroenterostomy stomas About 1941 the number of partial gastrectomies equaled the number of gastroenterostomies, and for the last several years the ratio of these procedures has remained about 3 1.

Pyloroplasty, the most conservative operation was reserved for the youngest patients and in most instances performed for a minimal lesion which could be readily mobilized *Resection was done for patients in the late thirties* whereas gastroenterostomy was utilized for those whose average age was greater by about 14 years. Devine operations were done in older patients who had had massive hemorrhage and for whom a more radical procedure would have imposed a prohibitive risk. The ratio of men to women was 87 13

No further surgery was required in the patients in whom the ulcer was included in the resected portion of the stomach. When the ulcer was excluded additional surgery was required for gastrojejunal ulcer in four and gastrojejunitis in two In the gastroenterostomy group 17 required a secondary operation for gastrojejunal ulcer and 6 for malfunctional gastroenteric stoma. Further surgery was necessary for 24 per cent of those who had pyloroplasty Most patients with gastrojejunal ulcers after gastroenterostomy were young and had gross evidence of active duodenal ulcer Gastroenterostomy was performed in 45 women, but in none did a stomal ulcer develop

Uncomplicated duodenal ulcer warrants an adequate trial of rigid conservative treatment before surgery is considered. About 80 per cent of the patients can be managed satisfactorily with conservative treatment. *Surgery should* be reserved for complications such as perforations (acute subacute or chronic) cicatricial pyloric obstruction, hemorrhage (particularly in patients over age 55) intractability on a well formulated medical regimen or any combination of these factors. Gastroenterostomy is indicated for patients

over 55 who have a long-standing ulcer with relatively low gastric acidity and with symptoms due primarily to cicatricial pyloric obstruction. Partial gastrectomy usually should be reserved for patients under 55 with relatively high gastric acidity and for whom all clinical evidence suggests an active ulcer. Exclusion of a deeply situated ulcer of the posterior wall is safer than attempting to remove it.

Resection for Exclusion in Duodenal Ulcer: Technic and Results. A. Fromme[3] (Dresden) believes that resection for exclusion fell into disrepute because certain details of the procedure described by Finsterer were not carried out. Suc-

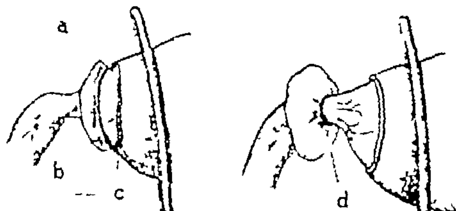


Fig. 115.—Extirpation without opening the lumen. *a*, unopened mucosa. *b*, seromuscularis apron at beginning of dissection. *c*, point of incision of seromuscularis. *d*, pyloric ring. (Courtesy of Fromme, A.: Chirurg 19:483-485, October 1948.)

cess of this operation definitely depends on meticulous technic. Two frequently neglected features are maintenance of adequate blood supply to the pyloric region and proper closure of the pyloric stump. These two aspects of the operation are therefore described.

PROCEDURE.—The site of resection 2 or 3 cm. from the pylorus is determined and marked with two silk sutures; ligation of the gastrocolic ligament and lesser omentum should not go beyond this point because of the danger of tying vessels too close to the pylorus and thereby compromising the blood supply to it. Placing of a clamp on the pyloric end of the stomach is also risky, especially if it should include the pyloric ring. Beyond the pylorus, a clamp might grasp the ulcer or perforate a penetrating ulcer. The mucosa is excised without opening the lumen and a clamp is applied just before actual resection (Fig. 115). If the mucosa is opened during the procedure,

(3) Chirurg 19: 483-485, October 1948.

the rest of the operation must be carried out without a clamp and with aspiration of regurgitating bile or pancreatic secretion.

After extirpation of the mucous cylinder, closure is done in three steps (1) the pyloric mucosa is closed, (2) the seromuscular coat is sutured with deep-biting buttonhole stitches, and (3) the serosa is not inverted, the sides being laid one on top of the other and sewed

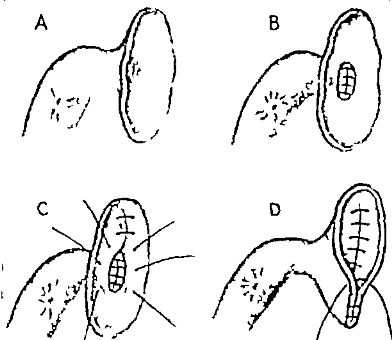


Fig. 116 —Closure of stump. *A* duodenal stump still open *B* closure of mucosa *C*, deep-biting buttonhole stitches; *D* serosal suture (without inversion) (Courtesy of Fromme A.: Chirurg 19:452-456 October 1948)

in position (Fig 116) Inversion of this stump of serosa is almost never satisfactory and should not be attempted.

In 10 years Fromme performed this operation 89 times, always on patients in whom gastric resection including the ulcer was impossible When the antral mucosa has been completely extirpated, the ulcer does not recur Because the operation was done in the most difficult cases, mortality was high—15 7 per cent. Death was due to defective closure of the stump with peritonitis in six cases

Surgical Treatment of Nonresectable Duodenal Ulcer Antral Exclusion Operation (Bancroft-Plenk Modification) M Makkas (Athens) and G Marangos[4] (Limassol, Cyprus)

(4) Brit. J Surg 37:206-212 October 1949

state that since 1937 this has been the operation of choice in the surgical clinic of the Red Cross Hospital Despite the simplicity of the technic, certain precautions are necessary for success For instance, it is a bad mistake to try to mobilize the duodenum, cut the blood supply and then, seeing the impossibility of radical resection, conclude the operation as a resection for exclusion, because necrosis, leakage and bleeding are likely to occur Further, vessels of the prepyloric section must not be ligated In coring out of mucosa, bleeding is not troublesome but careful hemostasis is essential Postoperatively, the danger of blowing up of the duodenal stump through gastric distention from stasis and accumulation of blood must be avoided through regular use of Ryle s tube

TECHNIC.—The vessels of the greater and lesser curvatures are ligated, starting 2 in proximal to the pylorus. Circular division of the seromuscular coats of the antrum, 3-4 cm. above the pylorus, is performed between clamps. The mucosal cone is separated down to the pylorus and the base of the cone ligated. It is easier to divide the stomach between clamps 2 fingerbreadths above the pylorus. The divided stomach is covered and reflected to the left The mucous membrane of the prepyloric antrum is grasped with Allis forceps and partly by blunt, partly by sharp dissection is cored out from within as far as the pylorus The cone of mucosa is transfixed at the base as deep as possible, the rest of the mucosa being removed in the manner suggested by Bancroft.

Plenk s method concerns the manner of closing the small pyloroantral pouch This is done from within without invagination, by three rows of sutures the first close to the pylorus unites the posterior seromuscular duodenal wall to the anterior wall with fine cat gut stitches (the authors prefer a purse-string suture) the second unites the anterior to the posterior wall with interrupted stitches, obliterating the remaining cavity the third unites the cut end of the antrum with silk sutures. After careful hemostasis the stump is covered with omentum.

The operative mortality among patients with duodenal ulcer fell from 6 9 per cent during 1931-41 to 3 5 per cent during 1941-47 The highest mortality was encountered with gastroenterostomy because this operation was performed only in patients who were bad risks. Radical resection showed a decline in mortality from 6 9 per cent to 3 1 per cent in the two periods Of 269 antral exclusion operations with conservation of the pylorus, 26 were performed by Finsterer s original method with stump invagination mor

tality was 15 per cent. The other 243 patients were operated on according to the Bancroft-Plenk modification, the mortality was 2.3 per cent. The exclusion operation with removal of the pylorus is much more dangerous and had a mortality of 7 per cent.

Ninety five per cent of the patients were definitely cured by the Bancroft Plenk method No suspicion of recurrent ulceration was noted, although some patients had been operated on several years ago and quite a large number with jejunal peptic ulcers had been operated on after gastroenterostomy and even some after radical resection.

Precautions and Results in Gastrectomy Ward H. Eastman and Warren H. Cole[5] (Univ of Illinois) state that *operative mortality rate for gastrectomy has dropped to* one third or one half of that of 15-20 years ago The technic and the ability of the surgeon have changed little during this period. Therefore, better understanding of the physiology of the gastrointestinal tract and improved pre- and postoperative care are *primarily responsible for improvement* in immediate results.

Important precautions in minimizing the mortality rate are preoperative correction of dehydration, electrolytic imbalance, anemia and hypoproteinemia. Vitamin therapy is important when the patient shows evidence of malnutrition with decrease in oral intake from day to day Use of the Abbott-Rawson tube has been of definite value in postoperative care and limitation of salt intake to 1 or 2 Gm during the first two postoperative days has been an important factor in eliminating oliguria. In addition, ample amounts of fluid must be given to maintain urinary output of 1,000 cc. daily The patient must be turned frequently and encouraged to cough as soon as he comes out of anesthesia. To encourage deep breathing and minimize atelectasis, inhalations of carbon dioxide must be given every hour for the first few days except while the patient is asleep

The authors are convinced that a duodenal ulcer should not be resected if its removal would leave such a short stump as to jeopardize its inversion. They have left 87 duodenal ulcers in place and have had no complications from

(5) Arch. Surg. 59:768-782, September 1949

them The only exception is made for patients with active hemorrhage

At Illinois Research Hospital during the past 13 years 191 gastrectomies were performed Mortality rate was 11 4 per cent for subtotal gastrectomy for carcinoma and 5.2 per cent for ulcer, an average of 7 6 per cent for 184 sub total gastrectomies During the past few years mortality has been lower than during the first part of the period studied The rate in gastrectomy for benign ulcer at present probably should be less than 3 per cent

Atelectasis was the commonest complication but accounted for only one death Pneumonia was diagnosed in 12 cases, but only one of the patients died The highest number of deaths from any complication was associated with leakage of the duodenal stump and cardiac disease (three deaths each)

Simple Antrectomy, Curative Intervention for Ulcer Disease with High Gastric Localization (Operation of Kelling Madlener) Experimental and Clinical Considerations

L Deloyers[6] (Brussels) states that from the surgical view point the Kelling Madlener operation belongs to the logical interventions which aim at radical cure of ulcer It is a functional intervention in which removal of the reflexogenous antral zone leaving the fundus, results in constant and definitive anachlorhydria at least after the Polya type operation This modification of the gastric milieu is sufficient to produce rapid healing of the subcardial ulcers which are not touched and no recurrence has been observed. Deloyers performed the operation more than 12 times with no deaths even in elderly patients

Postoperative observation of these patients afforded interesting information on the pain mechanism of ulcers The pain disappears immediately, constantly and permanently after operation, although the ulcer is left strictly alone, the only thing that is changed is the reaction of the intra gastric milieu which becomes anachlorhydric Thus, regardless of what the apparatus of perception of ulcer pain may be, there is pain only when free acid is present. When free acid is eliminated pain disappears The operation is

(6) Lyon chir 45 265 274 April, 1950

particularly suitable for lesions which can only be extirpated with great difficulty, endangering the patient, and for ulcers located high enough to allow resection of the entire antrum. If this is not possible, free hydrochloric acid will return with recurrence of the ulcer Unfortunately, leaving the lesion in place may lead to more or less severe postoperative hemorrhage, resulting from the vasodilatation of healing which involves the entire contiguous vascular area.

The operation confirms in man a series of concepts which Delovers had formed in experiments on dogs concerning the pathogenic role of hydrochloric acid. It demonstrates the validity of Mann's method of draining the duodenum in the study of the pathogenesis of ulcer

Surgical Management of Gastric Ulcer High on Lesser Curvature J William Hinton and S Arthur Localio[7] (New York Post Grad. Med. School) describe a procedure used in 13 patients with but one fatality, from bronchopneumonia

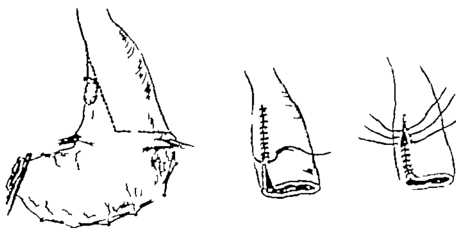


Fig. 117 (left) —Lesser and greater curvatures mobilized line of transection of stomach shown.
Fig. 118 (right) —Technic of repair of gastric pouch.
(Courtesy of Hinton, J W., and Localio S A. Arch. Surg. 60 267 273 February 1950.)

and peritonitis. It permits removal of a sufficient amount of stomach to reduce free hydrochloric acid nearly to zero, the ulcer may be examined by a pathologist and a pouch of stomach is left behind which obviates the physiologic changes of total gastrectomy

(7) Arch. Surg. 60 267 273 February 1950

METHOD.—The incision begins at the left costal margin opposite the eighth interspace and is carried downward and to the right in a gentle curve to a point at the linea alba halfway between the xiphoid and umbilicus. It is then carried transversely 1 2 in beyond the lateral border of the right rectus muscle. Additional exposure may be obtained by extending the incision at either or both ends. Resection is begun by transecting the gastrocolic omentum. The pylorus and first portion of the duodenum are then mobilized, and a Kocher clamp is placed on the duodenum just distal to the pylorus. During

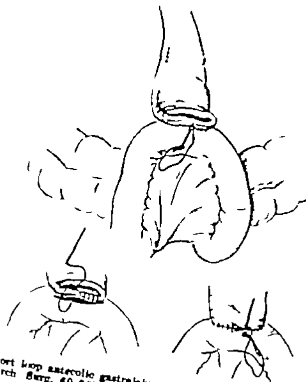


Fig. 119.—Short loop antecolic gastrojejunostomy. (Courtesy of Hinton, J. W., and Localio, S. A. Arch. Surg. 60 267 273. February 1950.)

mobilization of the first portion of the duodenum, the right gastric and superior and inferior pancreaticoduodenal arteries are ligated. The duodenum is transected but crushing clamps are not placed on the portion that is to be closed. Duodenal closure is accomplished by inversion with four layers of interrupted cotton sutures and fixation to the adjacent pancreas. The greater curvature is freed beyond the entrance of the short gastric vessels along the gastrolienal ligament (Figs. 117 and 118). The lesser curvature is then freed as far as the esophagus and the left gastric artery secured as it emerges from the celiac plexus. The stomach is transected between Kocher clamps. To avoid leaving crushed stomach behind, the clamps may be applied to the specimen only and the vessels individually ligated in the remain

ing pouch. The lesser curvature is reconstructed with two layers of interrupted cotton sutures so that the remaining stomach has the shape of an elongated tube continuous with the esophagus. An antecolic short loop gastrojejunostomy with use of continuous surgical gut sutures is shown in Figure 119 The abdomen is closed in layers with cotton and without drainage. The Levin tube is left in situ for 72 hours postoperatively and permitted to drain by gravity In the first 24 hours the tube is irrigated hourly to check its patency Clear fluids are permitted immediately after operation soft nonresidue foods are allowed after the tube is removed and the diet is rapidly liberalized thereafter until by the ninth day the patient is receiving a full bland diet in five feedings. Patients may usually be discharged in 9 11 days.

Total Gastrectomy H. William Scott, Jr , and William P Longmire, Jr ,[8] review results in 63 cases in which operation was performed by the various members of the Johns Hopkins Hospital surgical staff Indication for total resection of the stomach was gastric malignancy in all patients but one who had Banti's syndrome and gastroesophageal varices and had been subjected to many operative procedures before introduction of lienorenal anastomosis, subtotal esophagocardiectomy was ineffective, but total gastric resection eliminated all signs of hemorrhage from the alimentary tract. Three diagnostic errors were made in patients with benign ulcer who were submitted to total gastrectomy one had a large inflammatory mass around the ulcer and the other two a large ulcer high on the lesser curvature The rationale of total gastrectomy for malignant tumor is to effect block removal of the tumor and its primary avenues of invasion as radically as possible together with all regional lymph nodes.

Usually an upper midline incision with extension up to the left of the xiphoid was used. After determination of operability, stomach and great omentum were removed. In 57 instances, anastomosis was carried out between the end of the esophagus and the side of the jejunum. The loop of jejunum was usually brought up through a rent in the mesentery behind the colon, but in several instances an antecolic type of anastomosis was done An additional enteroenterostomy between afferent and efferent limbs of the jejunal loop was performed in 24 patients. Six were treated by esophagoduodenostomy Postoperatively patients

(8) Surgery 26:498-498 September 1949

were kept on parenteral feeding for four days and most of them were on a soft solid diet in six small feedings by the eighth to tenth day and were discharged from the hospital by the fourteenth day

There were six deaths (9 5 per cent) leakage at the esophagojejunal suture line was the cause of three Post operative course of most of the 57 survivors was uneventful. Most patients experienced varying degrees of epigastric fulness after being put on solid food, about one third had epigastric burning during and after meals, apparently owing to reflux of bile and pancreatic juice into the lower esophagus, but this was usually transitory and was much less frequent in patients who had had enteroenterostomy Operative mortality for partial gastric resection for malignant tumor at this clinic in the period covered by this study was 13 per cent

Of the 63 patients treated by total gastrectomy, 28 (44 per cent) were living at the time of writing, 18 (29 per cent) had lived one year or more, 11 of the 18 were alive one or more years after operation (18 per cent) and 3 were alive after over four years Seventeen patients died of recurrence less than six months after operation. Most of these had first appeared for definitive treatment 12 months or more after onset of symptoms of gastric disorder the tumor was doubtless microscopically far beyond the limits of any possible block excision at the time of operation, but it is also possible that in a few instances the surgeon seeded the peritoneum with carcinoma cells by poor technic in taking a biopsy specimen of the tumor before resection or by ill advised manipulation of a tumor which had extended through to the serosal surface of the stomach wall.

Survival times are too short and the number of cases of total gastrectomy is too small to compare the late results with those after subtotal resection. However there are theoretical considerations and some actual indications from this series that total gastrectomy is a more effective treatment of gastric cancer than subtotal resection.

Management of Rupture of Duodenum Due to Violence Vinton E Siler[9] (Univ of Cincinnati) reports one case of

(9) Am. J Surg. 78:718-722, November 1949

intraperitoneal and three of retro or extraperitoneal rupture of the duodenum in which surgery was successful.

With a history of nonpenetrating injury to the abdominal wall the likelihood of rupture of fixed intra-abdominal organs such as the liver, spleen, kidneys and fixed portions of the gastrointestinal tract should be considered Both intra and extraperitoneal duodenal rupture may result in peritoneal irritation. Pain is usually localized in the epigastric region but may oscillate between right and left hypochondriac regions. It may not be as diffuse in extraperitoneal as in intraperitoneal rupture Abdominal rigidity localized tenderness in the epigastrium and nausea and vomiting may occur Hypoactive peristalsis or absence of peristalsis indicates peritoneal irritation and suggests peritonitis Obliteration of liver dulness may follow a rapidly produced pneumoperitoneum which results only from rupture of a hollow viscus This finding can be confirmed in most cases by x rays in which presence of air about the right kidney may be evidence of extraperitoneal rupture Pain in the testes may signify irritation in the retroperitoneal tissues The duodenum is the most important hollow viscus subject to rupture and capable of allowing escape of air to pelvic tissues. Physical findings suggesting intra or extraperitoneal abscess may call attention to a previously ruptured duodenum

Laboratory determinations show a white cell count between 10 000 and 40 000 In some instances blood amylase may be elevated X rays of the gastrointestinal tract utilizing lipiodol* or thin barium sulfate are the most valuable laboratory procedures available With intraperitoneal rupture of the duodenum a definite sinus may be visualized With extraperitoneal rupture an x ray taken either in the oblique or lateral position may demonstrate a sinus leading from the duodenum. Despite such aids preoperative diagnosis of duodenal rupture is not always easily established. Because of modern methods of treatment, prognosis in this condition is better than formerly

METHOD.—The patient should be put at bed rest and oral intake discontinued. Demerol* or morphine may be used to control pain, but the former is preferable because it has an atropine-like action and diminishes gastric secretions. Water and electrolyte balance are

maintained parenterally Blood and blood substitutes should be given early if indicated Since several types of organisms may be present, penicillin 300 000 units daily, streptomycin 0.5 Gm twice daily, and sufficient sulfadiazine intravenously to maintain a blood level between 8 and 13 mg should be given Continuous gastric aspiration should be maintained The patient may be observed frequently for two to eight hours, the time being utilized to improve his condition and establish a more accurate diagnosis At operation supportive therapy must be given and whole blood must be available

Exploration of the abdomen should be so thorough that no pathologic lesion will be overlooked. In Siler's series tears occurred at the junction of the second and third portions of the duodenum. Adequate surgical repair is based on good approximation of the mucosal surface using a Connell suture of continuous gastrointestinal no. 000 chromic catgut The muscular and serosal coats are reinforced with either silk or Halsted mattress sutures of medium silk. Use of drainage depends on the degree of infection and amount of devitalized tissue. Cigaret drains are perferred and should be brought from the peritoneal cavity through a stab wound rather than through the working incision. Extraperitoneal rupture may not be visualized clearly and is frequently diagnosed by presence of a hematoma in the base of the mesocolon The duodenum may be edematous and discolored by a retroperitoneal clot or collection of bloody fluid. The duodenum is mobilized and explored by incising the posterior parietal peritoneum along the right lateral border After mobilization toward the left gutter, the rupture may be demonstrated easily and the same type of operative repair performed The retroperitoneal area is always drained. Special care must be taken not to damage major blood vessels when the rupture occurs in the fourth portion of the duodenum.

Postoperatively, patients should be treated the same as any who have gastrointestinal surgery by continuous gastric suction, maintenance of water and electrolyte balance and chemotherapy

Mechanism of Postgastrectomy "Dumping" Syndrome This syndrome consists of any combination of the following a feeling of warmth, sweating, tightness or pain in the epigastrium, nausea weakness, palpitation, vertigo or collapse Observations by Thomas E Machella[1] (Univ of Pennsylvania) on 16 patients with such symptoms who had had subtotal gastrectomy indicate that they are caused by distention of the jejunum due to outpouring of fluid from the jejunal wall in an attempt to dilute hypertonic food material passed along by the nonretentive stomach. The symptoms may occur at the end of or shortly after completion of a meal when the hypertonic solution first reaches

(1) Ann. Surg 130:145 159 August, 1949

the jejunum, or at some time after completion of a meal when the stoma is small and not situated in the most dependent portion of the gastric remnant.

Though hyperglycemia may be demonstrated during the symptom period, for several reasons it is not a causative factor. Symptoms may occur before hyperglycemia develops following intrajejunal instillation of glucose solution. They do not occur when hyperglycemia is induced by intravenous *injection of glucose. In a completely gastrectomized patient* the postprandial blood sugar concentration may be high in absence of symptoms. Administration of hypertonic solutions of magnesium and sodium sulfate may produce dumping symptoms but not hyperglycemia.

Although the dumping syndrome can be reproduced by balloon distention of the intestines, other conditions must also prevail. Ingredients of high osmotic pressure (over 300 milliosmols) such as sugar, salt or protein products, must be present in the meal. Sufficient fluid must be ingested to dissolve these substances so that the result is a hypertonic solution of sufficient strength to draw additional fluids from the blood stream into the intestine. If vomiting occurs or a horizontal position is assumed so that jejunal contents flow back into the gastric remnant, the increased bulk caused by dilution will not distend the jejunum and the symptoms will not occur. Excessive hyperactive peristalsis may disperse the meal rapidly throughout the small intestine and so dissipate the effects of the gut-distending mechanism. If fluids cannot be mobilized readily from the blood stream and enter the intestinal lumen with sufficient rapidity to distend it, symptoms will not occur.

These observations showed that symptoms could be prevented by omitting fluids from meals. In such cases liquids are ingested between meals. Administration of physiologic doses of atropine before a meal was also effective in preventing early symptoms in most instances. Atropine may act by relaxing the intestine beyond the point at which active distention is produced. Its action does not seem to be due to interruption of afferent or efferent pathways in the vagus nerves because vagotomy does not prevent the symptoms.

Postgastrectomy and Postvagotomy Syndrome was studied by N C Jefferson C W Phillips R Levine and H Necheles[2] (Chicago) in 10 normal dogs which had Polya type subtotal gastric resection, gastrojejunostomy, Hofmeister type subtotal gastric resection, gastrojejunostomy and enteroenterostomy, pyloroplasty or bilateral supradiaphragmatic vagotomy alone or in combination with gastrojejunostomy

Symptoms of postprandial syndrome were observed in only one animal. After a Polya type subtotal gastrectomy, vomiting occurred two to three hours after feeding and simultaneously blood sugar was 36 mg per cent Although gastric emptying time was reduced in this animal, it was not short enough to be called dumping Apparently the second phase of the postprandial syndrome was present without the first The oral glucose tolerance curves were higher and more sustained in three of four dogs after subtotal gastrectomy and even higher when transthoracic vagotomy was also done

Intravenous fructose tolerance tests showed normal curves before and after the various operations but the five minute glucose values rose sharply This was attributed to release of epinephrine causing glycogenolysis or direct release of glucose from the liver In one normal dog and one with a Polya type subtotal gastric resection, neither olfactory nor gustatory stimulation had stimulatory effects on blood sugar levels. Reports by other authors of rapid gastric emptying or dumping could not be confirmed.

Reoperation disclosed that large stomas had become smaller and small stomas larger all attaining a relatively uniform size

Inadvertent Gastroileostomy William H Moretz[3] (Univ of Utah) reports a case

Woman, 38, was admitted for diarrhea, severe weight loss and increasing weakness for 18 months since she had undergone subtotal gastrectomy for duodenal ulcer She was barely able to raise her head from the pillow or her knees from the bed and could not lift either entire lower extremity Except for extreme emaciation, abnormal physical findings were scarce. A barium enema revealed the cecum and ascending colon to lie on the left side of the abdomen just to the right of the descending colon. No connection between

(2) J Appl. Physiol. 2 469 476, February 1950
(3) Ann. Surg 130 124 126 July 1949

stomach and colon was visible. A gastrointestinal series demonstrated a patent anastomosis between the stomach and the distal third of the ileum without connection with the large bowel. Within two hours, ingested barium was observed in the cecum. A high calorie, high protein diet was tried but no gain in weight or strength resulted.

Because it was thought that the patient would require jejunostomy feeding before she could be built up enough to stand a major operation, a Witzel type jejunostomy was performed and a developmental

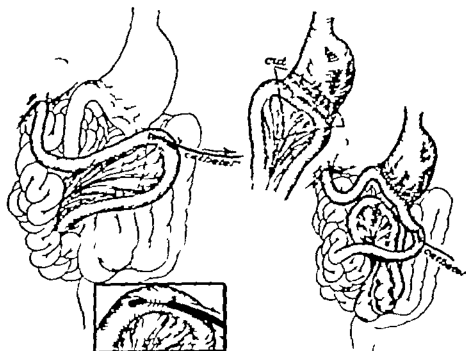


Fig. 120 (left).—Witzel jejunostomy performed at point about 15 in. from duodenojejunal junction. Abdominal opening made to left so as not to interfere with contemplated reconstructive surgery.

Fig. 121 (right).—In upper figure broken lines indicate limits of resection. After excision of this area, end-to-end anastomosis was made between two ends of ileum. Gastrojejunostomy was completed to jejunum at point about 8 in. proximal to jejunostomy. Lower figure shows relation between gastrojejunostomy, jejunostomy and ileum when completed.

(Courtesy of Moretz, W. H. Ann. Surg. 130 1 4 138 July 1949.)

anomaly of the gastrointestinal tract with faulty rotation of the midgut found. The jejunostomy was done about 15 in. from the duodenojejunal junction with the abdominal opening in the left middle quadrant (Fig. 120). The patient was given a special formula of predigested food and gained weight and strength until in about three weeks she could walk unassisted for the first time in seven months. Three weeks later operation confirmed the anomaly of rotation. The gastroileostomy was resected, removing the distal inch of remaining stomach and the attached ileum. An end-to-end aseptic anastomosis was made between the two ends of ileum using a single row of Hal

sted sutures of no 60 cotton A gastrojejunostomy was formed anastomosing the jejunum at a point about 8 in proximal to the feeding jejunostomy to the distal end of the remaining stomach (Fig 121) Postoperative course was uneventful Ten months after operation she was asymptomatic and the jejunostomy had closed.

The signs and symptoms in this case were typical Onset of diarrhea three days after the supposed gastroenterostomy should have aroused suspicion and its persistence with loss of weight and strength would support such a suspicion Rapid filling of the colon after barium was swallowed was practically diagnostic The lack of reflux into the stomach of barium given as enema was evidence against a gastrocolic fistula Gastroileostomy alone is less serious than when accompanied by gastric resection because a part of the food goes through the entire small bowel

Probably, gastroileostomy is usually a mistake due to inexperience The most useful landmark in choosing a loop of jejunum for gastroenterostomy is the ligament of Treitz. In the absence of this ligament as in the present case, an anomaly of rotation should be suspected and a loop selected by tracing the duodenum distally or the small bowel proximally from the cecum Treatment depends on existing conditions Block resection of the gastroileostomy is advocated for patients who have had subtotal or partial gastric resection For those who have not had gastric resection satisfactory results may be obtained by taking down the gastroileostomy and combining this with a subtotal gastrectomy or a vagotomy Twenty four instances of gastroileostomy have been reported previously in sufficient detail for study 22 were done without gastric resection and only 2, plus the present case followed partial gastric resection Probably the reported instances of this type of surgical error represent only a small percentage of the actual number committed

Pyloric Obstruction

Prolapse of Gastric Mucosa Report of 22 Cases is made by Henry G Rudner[4] (Memphis, Tenn.) The preponderance of men over women was striking there were 19 men and 3 women. The commonest etiologic factor in all gastric mu

(4) South. M. J 43 486-489 June 1950

cosa prolapse is excessive gastric peristalsis. It is probably initiated by the same agents which give rise to duodenal ulcers If prolapse persists, gastritis may occur

Symptoms may be similar to those of other gastric and duodenal disorders, but an outstanding feature is inconstancy of clinical manifestations both in degree and in duration. Commonly, there are epigastric fulness, distention, heartburn and colicky pain, which begin one half to one hour after meals and are relieved by vomiting Physical examination and laboratory studies may be negative, but in more advanced cases a soft, movable mass may be detected in the pyloric region If x rays demonstrate definitely and repeatedly a characteristic mushroom-shaped filling defect of the duodenal bulb prolapse of gastric mucosa should be strongly suspected. Differential diagnosis includes duodenal or prepyloric ulcer duodenitis, prolapsed gastric polyp antral gastritis or hypertrophy of the pyloric sphincter

Patients with a mild or moderate prolapse usually respond to conservative measures such as frequent small feedings of a bland diet, small doses of sedative and omission of tobacco, alcohol, condiments, spices, coffee and tea. Rest and relief from mental disturbances are essential, antispasmodics are of doubtful value Surgery is indicated for extensive prolapse, bleeding severe gastric retention or associated ulcer Since the prolapse may easily slip back into the stomach it may not be palpable at operation. The surgeon should not hesitate to open the stomach if x ray evidence is conclusive Excision of the redundant mucosa and pyloroplasty or partial gastric resection may be used

[The author's series of 22 cases would make it seem that prolapse of the gastric mucosa is a fairly common condition. Yet in the experience of most surgeons it is very rare, at least as a cause of symptoms or disturbed function. In the opinion of the editor one should be very hesitant in making such a diagnosis Yet as shown in the following abstract the condition may be responsible for some of the obscure hemorrhages in the stomach not associated with demonstrable ulcer or carcinoma.—Ed.]

Prolapse of Gastric Mucosa through Pylorus Presentation of Case with Severe Hemorrhage A. E Moon, Sr and Terrell Speed[5] (Temple, Tex.) state that the etiology of

(5) South. M. J 42:839-844 October, 1949

prolapsed gastric mucosa is unknown but that factors probably vary with the individual case There are no characteristic symptoms Most often patients complain of vague indigestion, gas or bloating and cramp-like feelings, such symptoms usually being more pronounced soon after a meal *Diagnosis cannot be made on the basis of clinical history*, but its possibility should be kept in mind when these symptoms are present Many patients in whom examination of



Fig 122.—Stomach showing defect in base of duodenum. (Courtesy of Moon, A. E., Sr., and Speed, T South. M. J 42 639-644 October 1949)

the upper abdomen is negative and who are diagnosed as having pylorospasm, functional indigestion or gastric neurosis may in reality have prolapsed gastric mucosa.

The responsibility for diagnosis is placed largely on the roentgenologist Since prolapse may be intermittent, x ray diagnosis is possible only with repeated observation. The x ray pattern is variable, but there may be a circular, irregularly circular or cauliflower like filling defect at the base of the bulb (Fig 122) The fluoroscopist may by chance see the loose mucosa passing through the pyloric canal.

Most patients should have a trial of medical management

consisting of bland soft or liquid diet small frequent feedings, antispasmodics and possibly elimination of nicotine, alcohol and caffeine Sedatives, bed rest and blood transfusions are recommended when indicated Patients with severe repeated hemorrhages, constant oozing of large amounts of blood or partial pyloric obstruction with gastric retention almost invariably require surgery The usual procedure has been antral incision, removal of the prolapsed portion of mucosa, suturing of cut mucosal border to the submucosa and some form of pyloroplasty When distinct obstruction or hemorrhage is present gastric resection of the involved area may be preferable.

Hemorrhage may be a prominent symptom, as evidenced by a patient who required 21 blood transfusions during her illness The cause should be sought in all cases of unexplained gastrointestinal bleeding

Hypertrophy of Pyloric Muscle in Adult Experiences with Conservative and Radical Surgical Treatment are described by James C McCann and Michael A Dean[6] (Tufts College) who report three cases In the adult, two distinct types of hypertrophy are seen the idiopathic type with no other demonstrable pathology within the gastrointestinal tract, and the concomitant type in which associated lesions such as gastric ulcer or chronic gastritis with superficial ulceration are found. In both types the circular muscle is hypertrophied just as in the infantile form with elongation and narrowing of the pyloric orifice This fact substantiates the concept that the adult form represents a subclinical variant of the congenital form. Others believe that autonomic imbalance in some way favors development of pyloric muscle hypertrophy

The Ramstedt procedure successfully used in infants, is not recommended for adults because (1) the defect would be fairly large inviting diverticulum formation (2) inadvertent mucosal lacerations may heal with scar formation and give only partial relief of obstruction (3) pylorus hypertrophy rare in adults may be confused with tumors whose eradication would be desirable Gastrectomy may be unnecessarily radical and physiologically not the most de

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(6) Surg Gynec & Obst. 90 535-542 May 1950

sirable method for reconstruction of the gastrointestinal tract In two patients treatment by conservative surgical procedures, such as pyloroplasty or gastroenterostomy, failed

Since changes are localized to the pylorus and the duodenum is usually freely movable, the Billroth I pylorectomy is particularly applicable It also leaves the physiology of the gastrointestinal tract less disturbed In one patient, a Billroth I reconstruction following pylorectomy gave satisfactory results.

Pyloric Hypertrophy in Adult John Paul North and James H Johnson, Jr.,[7] collected from the literature 59 cases with operative or autopsy verification and added 5 previously unreported cases Ratio of males to females is only 3 1 the male preponderance being not as overwhelming as in infantile pyloric hypertrophy

In adults thickening of the pyloric muscle probably persists asymptomatically from infancy Sometime in adult life a complicating factor such as inflammatory thickening edema or spasm may occur to precipitate symptoms of pyloric occlusion

There is no characteristic clinical picture of pyloric hypertrophy In 70 per cent of cases onset was between ages 81 and 60 Symptoms may be mild intermittent and gradually become more severe or complete pyloric obstruction may develop without prior warning About 70 per cent of patients had presenting symptoms of epigastric pain or discomfort and vomiting Roentgenographically there is usually a 25-50 per cent barium retention after six hours Extreme hyperperistalsis or gastric dilatation are unusual. The pyloric canal may be significantly elongated The mucosal pattern shows irregularities produced by rigid folds of edematous mucosa but pyloric ulcer may be eliminated by nonretention of barium flecks A mushroom deformity at the base of the duodenal bulb is probably not a reliable x ray sign of pyloric hypertrophy

At operation a firm tumor mass or thickening is usually palpable When the stomach appears normal the prepyloric portion should be opened and the interior inspected. The

(7) Ann. Surg. 131 316 3 9 March, 1950

pyloric ring should not be divided until after palpation, for this procedure makes evaluation difficult The outstanding pathologic feature is hypertrophy of the circular layer of muscle in the pyloric ring The longitudinal muscle may show moderate hypertrophy, and the submucosa and mucosa may be thickened by edema or chronic inflammation. The tumor may occupy the distal 3 or 4 cm of the stomach. It is thickest at the pyloroduodenal junction and fades out gradually over the gastric antrum Muscular hypertrophy stops abruptly at the pyloric ring

In some cases symptoms may be so mild and indefinite that no treatment is indicated. Gastrotomy may be necessary to exclude pyloric ulcer, prolapsing mucosa, pedunculated tumor or other lesions A limited gastric resection is the operative procedure of choice

NEOPLASM

Early Diagnosis of Gastric Carcinoma Pathologic Problems G Majno[8] (Geneva) states that periodic roentgen examination of the population, or at least of persons over 50, would be the surest method of discovering early cases of gastric carcinoma. However such a procedure would be practically impossible To remain within the limits of possibility, it would be necessary to examine only those persons particularly susceptible to development of gastric carcinoma because of age or local or even general pathologic conditions *The probabilities of malignant evolution should be considered in persons with chronic gastritis, pernicious anemia, gastric ulcer and gastric polyps*

A form of gastritis in which the capacity of malignant evolution is high is Konjetzny's hyperplastic gastritis with areas of polyposis, mostly localized in the pyloric antrum This variety is the rarest of gastritides, at least in its typical form Atrophic gastritis, by far the most frequent form, occurs too often in noncancerous subjects to be considered important as a precancerous condition. The problem is complicated by the existence of mixed, atrophic and hypertrophic types of gastritis Achlorhydria is observed in about two thirds of the cases of gastric carcinoma, and there is often progressive achlorhydria which precedes carcinoma

(8) Schweiz. med. Wchnschr 80 444 462 Apr 29 1950

Subjects with achlorhydria should be examined periodically Patients with pernicious anemia show a higher incidence of gastric carcinoma and benign tumors than those without this disease A higher incidence of gastric carcinoma has also been reported in their families It is therefore necessary particularly to observe these patients to detect early cases of carcinoma

Cancerization of gastric ulcer cannot be denied Majno estimates that it occurs in 5 per cent of extirpated ulcers He presents the hypothesis that exceptionally the morphologic picture of such ulcers could be imitated by that of a superficial ulcerated carcinoma

From the practical standpoint it is necessary to remember that cancerization of gastric polyps occurs relatively frequently The most dangerous but also the rarest form is the hyperplastic gastritis of Konjetzny for the other polyps (gastric adenomas) the percentage of cancerization varies from 6 to 68 per cent, depending on the authors

It does not appear that cytologic examination of gastric juice will aid much in early diagnosis of gastric carcinoma, even with Papanicolaou s technic This opinion is based on the excessive number of false positive and false negative results and the complexity of the procedure (intubation lavage etc) Biopsy with a Gelfoam sponge might be indicated as a complement to gastroscopy

Diagnosis of Gastric Cancer by Cytologic Examination of Gastric Washings is considered of limited value by Jerome M. Swarts Alex B Ragins, Arthur Bernstein and Jacob Meyer[9] (Cook County Hosp) Conclusions were based on cytologic study of 166 cases with proved diagnoses, including 67 of carcinoma of the stomach, 30 of gastric ulcer 35 of duodenal ulcer and 34 with various other diagnoses. In 99 cases without gastric cancer smears were unsatisfactory and not suitable for interpretation in 25 per cent. In the remaining cases, correct cytologic diagnosis was made in 90 per cent and false positive diagnoses in 10 per cent In cases of proved cancer of the stomach the frequency of poor preparations was 49 per cent Correct diagnosis was made in 44 per cent of the remaining cases and incorrect diagnoses in 56 per cent.

(9) Gastroenterology 14:268-274 February 1950.

These results do not differ greatly from those reported by others The large number of unsatisfactory preparations is attributed to obstruction of the cardia or pylorus with retention, very malignant tumors or extensive malignancies with much necrosis When results of gastroscopy and cytology are compared, the former seems more accurate but when results of both technics agree, they are both correct. A negative cytologic diagnosis is of little significance but a positive cytologic diagnosis should not be disregarded, irrespective of other negative findings Despite shortcomings the procedure was a valuable aid when other methods gave negative or equivocal results and the index of suspicion remained high The method does not appear to be of value as a screening test in diagnosis of cancer

Evaluation of Electrogastrography in Diagnosis of Gastric Cancer Using a slight modification of the Goodman method *Philip N Sawyer Jonathan E. Rhoads and Ruth Panzer*[1] (Univ of Pennsylvania) ran 130 tests on 106 patients and 20 tests on 12 normal subjects.

METHOD.—A Levin tube is passed into the stomach and filled with 0 1 N hydrochloric acid which permeates a sponge rubber plug in the lower end of the tube and, at the outer end, connects through a calomel half cell to a high resistance recording potentiometer The lower end of the tube is placed under fluoroscopic control against the gastric wall opposite the esophageal opening The other electrode is filled with 0.1 N sodium chloride and placed against a scarified area on the skin of the arm. The patient then lies down and the leads are connected to the potentiometer

The normal stomach is electrically negative to the skin by a potential difference of 20-80 millivolts. After a base line is obtained, the subject drinks 200 cc. milk and the record is continued for another 15 minutes. The test should be run after a fast of at least 12 hours. *The normal stomach has a smooth, even base line between 20* and 80 millivolts the response to milk is prompt and smooth gradually rising and then falling to the previous base line. In gastric ulcer the base line becomes more uneven and the response to ingestion of milk is usually immediate and prolonged, and may be very uneven. In duodenal ulcer with simultaneous gastric lesion the curve tends to resemble that of gastric ulcer In gastric carcinoma, the base line is moderately to extremely uneven and the response to milk is atypical in 87 per cent of cases either it does not take place in less than 60 seconds, or never becomes greater than 3 millivolts or does not last as long as 8 minutes.

(1) Surgery 26 479 487 September 1949

The results were analyzed in two ways by comparing the interpretation of the electrogastrograms recorded preoperatively with the pathologic findings at operation, and by setting up certain rigid wholly objective criteria by which all records could be classified as indicative of a benign status, and indicative of malignancy. By the more objective of the two 8.5 per cent of the records had to be discarded but in the remainder, the test was correct in 87 per cent of the patients with malignant gastric lesions and in 88 per cent of those without malignant lesions. Thus this experience confirms that of Goodman and, although the test is not to be relied on for definitive diagnosis of gastric malignancy, it may prove of value as a screening test in cancer detection for it should be less expensive than gastrointestinal roentgen examinations as now carried out.

By a process of exclusion the authors were led toward the belief that the gastric potential is the result of metabolic activity of the secretory cells

Serum Antiproteolytic Reaction of Patients with Lesions of Stomach and Duodenum. Using serial dilutions of serum, the inhibition of digestion of a known amount of fibrinogen by a known amount of trypsin was tested by Eugene E Cliffton and Louis E Young[2] (Yale Univ) Only 2 of 47 patients with a benign duodenal or gastric lesion without hemorrhage had a positive reaction, only 8 were in the doubtful range 2 had variable reactions and 35 had a negative reaction. Of 17 patients with carcinoma of the stomach without hemorrhage reactions were positive in 13 doubtful in 2 and negative in 2 Of 10 patients with severe hemorrhage, 8 had positive reactions and 2 negative All three patients who had carcinoma with hemorrhage had a positive reaction whereas two of seven patients who had ulcers with hemorrhage had a negative one

Of 19 patients who were examined at various times after resection for carcinoma 12 with no evidence of recurrence had a negative reaction however of 7 who had recurrence all but 1 had a positive reaction. Several patients who were followed from a period without recurrence through doubt

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(2) Cancer 3 485 492 My 1950

ful to definite recurrence showed elevated titers preceding a definite clinical diagnosis of recurrence

The authors conclude that this reaction is of value in screening patients for carcinoma and is helpful in reaching a diagnosis in cases of gastroduodenal lesions

Clinical and Pathologic Studies of Benign and Malignant Gastric Ulcers Orville F Grimes and H. Glenn Bell[3] (Univ of California) state that of 270 gastric operations performed from 1937 to 1948, 99 were for benign ulcers and 171 for carcinoma In the latter group the symptom complex was typical of peptic ulceration in 24 patients (14 per cent) Of these, 18 (75 per cent) had received medical therapy for periods varying from a few months to many years, the others had not sought medical aid Of the 18 patients cared for by physicians, progress of therapy was evaluated by roentgen studies in 13, and only 6 of these were checked at even partially adequate intervals

Although such repeated roentgen evaluation is essential, these follow up studies do not solve the problem. An ulcer may disappear completely but a microscopic focus of malignancy may be enclosed within the healing process; moreover these early carcinomatous foci often are of the highest grade of malignancy The tragedy of these cases is that the opportunity for complete surgical excision is often lost. Regional or even distant metastases may develop while the roentgen picture is most favorable At the opposite extreme many ulcers especially those associated with a generous amount of fibrous tissue, heal with preservation of a niche, giving the false impression of malignancy Even in these instances, to await exact clinical signs is to invite disaster The threat of cancer far surpasses the risk of surgical excision of benign ulcers which by all available investigative methods appear malignant.

Pathologic study in the 24 malignant cases with ulcer symptoms showed that three types of lesion can be identified (1) In lesions which contain a small focus of carcinoma in an ulcer with benign characteristics, the malignant change is apparent usually at the margin of the ulcer or immediately deep to its overhanging edge (2) In lesions in

(3) Surg Gynec. & Obst. 90 280 271 March, 1950

which it is probable that the ulcer developed from peptic erosion of a small primary carcinoma, the malignant cells may appear in the base of the ulcer as well as at its margins. (3) In cases in which obvious carcinoma was discovered at operation though ulcer symptoms had persisted for long periods, in some for 20 years or more (average 11 4 years) the lesions were such that it was impossible to determine whether they arose from pre-existing ulcers However, the long duration of ulcer symptoms, frequently recurrent in nature, suggests a definite relation to the development of subsequent carcinoma In the 24 cases there was one death

If the investigative procedures yield equivocal results i the initial examination of the gastric ulcer patient, immediate surgery should be undertaken. The risk of malignancy is far too significant for the physician to assume the responsibility of allowing a readily resectable malignant lesion to reach an inoperable state by prolonged injudicious therapy If surgery is indicated subtotal gastric resection with excision of the ulcer is the procedure of choice

Perforated Carcinoma of Stomach Simulating Perforated Gastric Ulcer is discussed by Richard Doll[4] (Central Middlesex Hosp) who compared 17 cases with 452 in which perforation of the stomach or duodenum was due to a benign ulcer Few patients with carcinoma were under age 40 and none were under 30 Since all perforations mistaken for simple ulcers occurred in men there may be some factor which makes men particularly liable to this complication. The over all risk of an apparently simple perforated ulcer being malignant was about 1 8 per cent, but in men with gastric ulcers it was 8 1 per cent

All investigators have stressed that this misdiagnosis is easily made, but most astonishing is the fact that in most instances carcinomatous perforation has been thought benign at operation. Possibly this is because most carcinomas which perforate are small, relatively confined lesions, presumably suitable for resection. It is possible that early carcinoma creates an area of decreased resistance to peptic digestion, permitting development of a secondary simple ulcer in which perforation may occur

(4) Brit. M. J 1 214-215 Jan 28 1950

Carcinomatous perforations certainly occur in women. A possible explanation for the sex difference may be that simple ulcers are relatively more likely to perforate in men than in women If errors are to be avoided, special attention must be paid to all perforated gastric ulcers in men. Even routine biopsy at operation cannot be relied on as carcinoma may not be present in the entire periphery of the perforation.

For patients with perforated gastric ulcer mortality is greater than for those with duodenal ulcers, 50 per cent have severe relapses, and 20 per cent have further major complications within five years The added risk of carcinoma in such patients makes immediate resection worthy of serious consideration in the limited group of perforated gastric ulcers in men over age 30

Gastric Perforation Clinicopathologic Study John G Shellito (Mayo Found) and Andrew B Rivers[5] (Mayo Clinic) present observations based on a study of 101 cases in which perforations were due to benign gastric ulcer and *94 in which they were due to a malignant lesion.* Only four of the perforations associated with cancer and only six of those associated with benign gastric ulcers were acute and free In both groups the remainder of the perforations were chronic In operative patients the incidence of proved perforated benign gastric ulcer was about 10 per cent, in contrast to the incidence of 1 per cent for carcinomatous perforation. Average age of all patients was 52 7 years Those with perforated benign gastric ulcer tended to be slightly younger than those with carcinomatous perforation. The ratio of males to females was 6 8 1 for perforated benign gastric ulcer and 3.9 1 for malignant perforation.

Duodenal ulcer was associated with benign gastric ulcer in 13 per cent of the patients In no instance was duodenal ulcer associated with perforated adenocarcinoma of the stomach. In two of the three patients with sarcoma of the stomach a duodenal ulcer was found A second gastric ulcer occurred in three patients with benign gastric ulcer, and in one of these both ulcers were perforated In two of those with gastric malignant lesions an additional malignant le

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(5) Gastroenterology 12 919 932 June 1949

sion of the stomach was found This coincidence of lesions emphasizes the importance of looking for the second lesion after the first one has been extirpated

A typical ulcer story was elicited in 61 4 per cent of patients with perforated benign gastric ulcer but in only 28 6 of those with perforated malignant lesion In both groups an insidious and slow onset of symptoms was the rule in 90-94 per cent A palpable mass was present in 25 5 per cent of those with malignant lesions but in only two with benign lesions No known bleeding was encountered in 62 4 per cent of those with benign ulcers and none in 64 8 per cent of those with malignant lesions The others had hematemesis or melena, or both benign lesions being the source of hemorrhage as often as malignant ones No features in the history physical examination or laboratory findings served to differentiate benign from malignant gastric lesions in individual patients Histologic examination of the lesion is the only certain method for such differentiation.

Almost all lesions, both benign and malignant were on the posterior wall of the lesser curvature Carcinomas were generally located at or near the pylorus and perforated benign gastric ulcer near the angle Obstruction occurred nine times more frequently with malignant lesions The pancreas was most commonly invaded by perforation and was involved in 51 per cent of malignant perforations and in 81 per cent of those due to benign ulcer Malignant perforations also involved the transverse mesocolon gastrohepatic omentum and undersurface of the liver The mean diameter of the malignant lesions was 2.52 cm and that for perforated benign ulcers was 1 85 cm., indicating that gastric ulceration larger than 2.5 cm in diameter is probably malignant About 75 per cent of perforated benign gastric ulcers in this group had a diameter less than 2 5 cm

Partial gastrectomy of some type was done on 95 8 per cent of the patients with chronic perforation of benign lesions A similar operation was done on 75.5 per cent of the patients with chronic perforation of malignant lesions Of 80 patients with malignant gastric perforations operated on more than five years ago 31 per cent lived five or more years after operation

In a comparison of benign with malignant *perforations*, initial gastrectomy, if possible, seems to offer the best solution to the problem of a free perforation. When there is a walled-off perforation of a benign ulcer an initial gastric resection is usually possible and preferable In patients with chronic perforation of a gastric malignant lesion, initial, partial or total gastrectomy is the best procedure If this is not possible, primary closure of the opening followed by partial gastrectomy later seems desirable In such cases excision of the lesion is a poor operation and warranted only as a palliative measure In any ulcer of the stomach many histologic examinations should be made before a diagnosis of benignancy is accepted

Extension of Carcinoma of Stomach into Duodenum and Esophagus M. M. Zinninger and William T Collins[6] (Univ of Cincinnati) studied operative specimens from 47 cases of gastric carcinoma. In 9 (30 per cent) of 30 cases in which the lesion was in the antrum and within 5 cm of the pylorus, there was duodenal invasion length of extension was *3 mm. in 2 cases, from 7 to 15 mm* in 4, 20 mm. in 2 and 60 mm in 1. These measurements did not allow for any shrinkage which had occurred. Invasion of the duodenum was principally by direct infiltration of the muscle or extension in the subserosal lymphatics in only three cases was it in the submucosa, one of the chief sites for extension in stomach and esophagus. In practically all cases invasion of the duodenum was recognized only by microscopic examination. In the case of 60 mm. extension, carcinomatous infiltration was present at the line of division of the duodenum, so that it obviously extended farther than that.

In five of six cases of cancer of the cardiac end of the stomach invasion of the esophagus was evident microscopically but there was gross evidence of invasion in only two Extension occurred principally in the submucosa, with additional extension in the longitudinal and circular muscle in some cases. The longest extension was about 25 mm., but at that point the esophagus had been resected

Extension in the wall of the stomach varied from 5 to 25 mm. No correlation could be found between the gross

(6) Ann. Surg. 130:557-566 September 1949

or microscopic nature of the tumor and the extent or likelihood of microscopic spread The principal site for extension seemed to be in the submucosal lymphatics As a rule, submucosal extension was not associated with thickening of the wall or palpatory evidence and consisted of inconspicuous clumps of cancer cells

In 9 (about 19 per cent) of the 47 cases the surgeon cut across carcinomatous tissue during resection In all carcinomas of the distal half of the stomach in addition to removal of the great omentum and as much of the gastrohepatic ligament as possible, the first portion of the duodenum should be removed As to resection proximally in the stomach, the surgeon should decide what he regards as a safe margin and then resect 1 or 2 in more For cancers of the cardiac end resection of some esophagus is necessary, 1 1/2 in may prove too little The plan recommended by Pack seems worthy of consideration, i e, frozen section of the cut end of the esophagus before anastomosis is done The authors now use almost routinely in all cases of gastric cancer the incision described by Carter for splenectomy

Identification of Regional Lymph Nodes by Means of Vital Staining Dye during Surgery of Gastric Cancer is possible with the following method according to Joseph Weinberg and E M Greaney[7] (Birmingham Veterans' Admin Hosp, Van Nuys, Calif.)

Method.—As soon as the abdomen is opened and diagnosis established, 4-5 cc. of 2 per cent aqueous solution of pontamine sky blue dye is injected into the anterior wall of the stomach, using a tuberculin type Luer syringe with a 26 gauge needle (Fig 123) By making injections in the muscularis along both curvatures, all or most of the regional groups of nodes receive the dye and variations in lymphatic patterns are negligible. The injection is made slowly to minimize puddling of the dye solution at the site While the injection is being made, streaks of dye may be observed in small lymph channels. If one or more of the regional nodes is not stained in the first few minutes, a second injection is made with the same dosage at adjacent sites. Resection is not started until 10 15 minutes after injection is completed to allow the dye time for passage from the stomach to the regional nodes. Severance of the major arteries and veins supplying the stomach is delayed for another few minutes for the same purpose since the major lymphatic vessels follow the blood vessels. During this period, excessive manipulation of the stomach

(7) Surg., Gynec. & Obst. 90:561 567 May 1950

is avoided to minimize the possibility of breaking off particles of cancer tissue into the circulation. After removal of the specimen, a careful search is made for nodes which might have been overlooked, particularly along the portal vein, in the region of the common duct and pancreas and along the remaining lower esophagus. Uptake of dye may be prevented by malignant involvement of lymphatics or nodes or acute inflammatory changes. Addition of hyaluronidase to

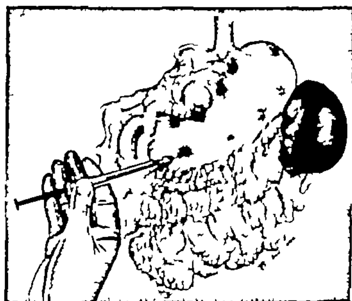


Fig 123.—Method of injection of dye into the muscularis of the stomach during surgery of gastric cancer. Several injections are made near the greater and lesser curvatures. (Courtesy of Weinberg, J., and Greaney, E. M.: Surg., Gynec. & Obst. 90:561-567, May 1950.)

the dye solution may accelerate its passage to the lymph nodes.

[*This seems to be a very simple and easy way to detect the lymphatics. The method should be given a good trial.*—Ed.]

Resectability of Recurrent Gastric Carcinoma. Gordon McNeer, Robert J. Booher and Lemuel Bowden[8] (Memorial Hosp., New York City) treated four patients during the past year by secondary operation and found it technically feasible and attended by satisfactory immediate results. Impetus for this work was largely due to experience with the first case in which a recurrence of cancer at the esophagojejunostomy site was readily resected a few weeks after total gastrectomy. 10 months later a second local recurrence was surgically excised. Jejunostomy would not have afforded this patient comparable palliation. A policy of

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(8) Cancer 3:43-56, January 1950.

performing secondary operations for gastric cancer in absence of distant metastases was then inaugurated Indications for secondary operation are identical with those for the original procedure

If carcinoma recurs locally after subtotal gastrectomy,

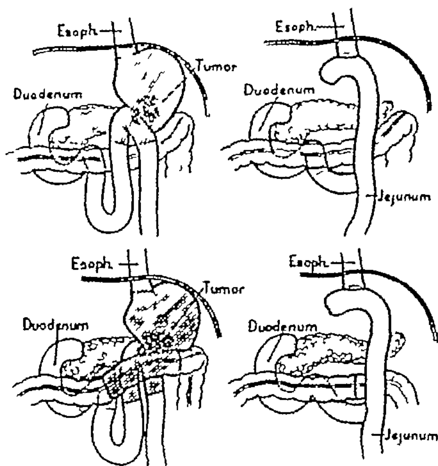


Fig. 124 (top left) —Anatomic relation and lines of resection presented when cancer recurs in gastric remnant anterior to colon.
Fig. 125 (top right) —Restoration of esophagojejunal continuity after method of Roux-en-Y in recurrence anterior to colon.
Fig. 126 (bottom left) —Anatomic relation and lines of resection when cancer recurs in gastric remnant posterior to colon.
Fig. 127 (bottom right) —Restoration of esophagojejunal continuity after method of Roux-en-Y in postcolic recurrence; colocolostomy supplementary cecostom as indicated.
(Courtesy of McNeer G., et al. Cancer 3 43-55 January 1950.)

involvement of the gastrojejunostomy would naturally be anticipated. Involvement of the gastrocolic mesentery and the transverse colon depends on whether this anastomosis has been constructed anterior or posterior to the colon. If

anterior, resection of the remaining stomach and contiguous jejunum is done with realinement of esophagojejunal continuity after the method of Roux-en Y (Figs 124 and 125) If a postcolic anastomosis has been previously performed, the transverse colon and its mesentery are inevitably compromised by the recurrent tumor, and encroachment of the growth on superior mesenteric vessels renders completion of the procedure hazardous and uncertain (Figs 126 and 127) If after careful evaluation resection *en bloc* seems feasible, the procedure is as follows (1) division of colon and mesocolon, (2) division of afferent and efferent loops of jejunum with identification and preservation of superior mesenteric vessels, (3) resection of gastric remnant, which may entail splenectomy and partial pancreatectomy, (4) restoration of esophagojejunal continuity after the manner of Roux en Y, (5) immediate end to-end anastomosis of colon with or without complementary cecostomy

At present, no claim can be made that these secondary procedures materially improve end results, but it seems reasonable to suppose that palliation, at least, is more effective if a mass of recurrent cancer is removed, particularly if it is producing obstruction and pain. The fact that recurrences were local and not associated with metastases suggests the possibility of some intrinsic variant that makes these cancers less aggressive and less prone to distant spread.

After primary gastrectomy for carcinoma it has long been the practice of the authors' clinic to use antecolic rather than postcolic anastomosis for restitution of intestinal continuity

[Only time can tell whether or not such a procedure will lengthen the life of a patient. At present it is to be regarded as an interesting experiment which seems justified at least in cases in which obstruction is present.—Ed.]

Giant Hypertrophic Gastritis Survey of Literature and Record of Case Treated Surgically is presented by W R. Forrester Wood.[9] Only about 40 cases of giant hypertrophic gastritis have been recorded Infection or chemical, thermal or mechanical irritants may predispose to the changes found, but the actual cause is unknown. Symptoms are those usually associated with a gastric disorder

(9) Brit. J Surg 37 278 282 January 1950

Roentgen examination showed rounded filling defects protruding into the lumen of the stomach, particularly along the greater curvature, which cannot be completely obliterated by pressure. Frequently it is not easy to differentiate hypertrophic gastritis from diffuse polyposis or adenomatosis of the stomach or, when the disease is localized, from carcinoma. Gastroscopy reveals enormous tortuous smooth folds separated by deep narrow fissures in the mucosa of the stomach. These folds, which suggest polyps, cannot be



Fig 128.—Photograph of stomach after being opened along the greater curvature, showing gross hypertrophy of mucosa. (Courtesy of Forrester-Wood, W R: Brit. J. Surg 27:278-282, January 1940)

obliterated by inflation, particularly along the greater curvature. They are loose, spongy, slightly bluish and almost transparent, whereas true polyps are solid, orange-red and completely opaque.

Surgical or postmortem examination shows that the stomach is considerably enlarged but that its serous surface is smooth. The muscular coats may be thickened and the mucosa shows enormous hypertrophy of the normal gastric folds, which become raised and tortuous and resemble cerebral convolutions (Fig 128). The whole mucosa is markedly

hyperemic These changes may involve the whole stomach or be localized to its midportion. Microscopically, metaplasia of the epithelium has occurred, columnar cells and goblet cells replacing the acid secreting and pepsinogenic cells of the normal mucosa The lower the acid index the greater is the change of epithelium toward the colonic type Complete achlorhydria is not a feature of giant hypertrophic gastritis

Treatment includes elimination of septic foci, particularly in the mouth and upper respiratory tract, and a diet like that used for peptic ulcer Gastric lavage with warm water containing sodium bicarbonate an hour before meals is useful Surgical treatment is justified in cases with progressive symptoms, extensive lesions and those which fail to respond to medical measures Total or subtotal gastrectomy should be performed as indicated a combined abdominothoracic approach being the most satisfactory for the former It makes possible easy esophagojejunal anastomosis and obviates a short jejunal loop with its attendant puddling in the proximal loop

Gastric Diverticula Jack Greenfield, Nathaniel E Rossett and Walter H. Mendel[1] (Memphis, Tenn) describe four cases observed at Kennedy Hospital from November 1946 to January 1948, bringing the number of reported cases to about 162. On a medical regimen alone (bland diet, postural drainage and antacids), relief was obtained in one case and partial relief in another In two cases operation was performed when medical management did not result in satisfactory amelioration

The diverticula were discovered during routine roentgen examinations of the gastrointestinal tract. Essential steps in the successful demonstration of gastric diverticula are (1) careful observation of the cardia during entry of the first barium swallowed (2) demonstration of the mucosal pattern by manual displacement (3) examination in recumbent and Trendelenburg positions in varying oblique projections, and (4) re-elevation of the patient to the vertical position. All are done with minimal barium filling The diverticulum is in the immediate vicinity of the cardia on the posterior

(1) Arch Surg 60 45 74 January 1950

wall close to the lesser curvature on which benign ulcers rarely occur It is usually spherical with a distinct neck, giving it a flask shaped appearance Its contours are regular mucosal folds extend into the neck and the gastric wall in its immediate vicinity does not deviate from normal Deviation from the classic appearance results from secondary inflammatory changes in the diverticulum

Histologically, definite evidence of inflammation was obtained in one of the cases in which operation was done In the other mucosal scarring in the apex of the excised specimen favored previous ulceration In addition to ulceration and inflammation hemorrhage neoplasm perforation and pancreatic tissue in the tips of diverticula have been reported. Excision, rather than inversion of the diverticulum, has been practiced by most surgeons This would seem the more desirable policy in good hands in view of the possible presence of pancreatic tissue ulcer or neoplasm in the tip

Exposure of gastric diverticula at the cardiac end of the stomach and their excision are best accomplished by the thoracoabdominal approach, because the exposure is more complete there is less danger of hemorrhage since the left gastric and short gastric vessels can be divided under direct vision there is less shock a lighter plane of anesthesia and less anesthetic agent are required and the postoperative condition is better than when the abdominal route is used.

TECHNIC.—The abdominal incision longitudinal or transverse is extended intercostally along the left eighth interspace, the pulmonary ligament is divided and the diaphragm is split down to the esophageal hiatus. Rib spreaders are inserted. By division of the gastrolienal and gastrocolic ligaments and drawing of the fundus down medially the diverticulum is exposed. For diverticula nearer the lesser curvature, the proximal end of the gastrohepatic ligament may be divided along with the left gastric artery if necessary to expose the lesion. If the diverticulum is not located with these maneuvers, a small incision should be made anteriorly in the stomach, the opening into the diverticulum located and a finger or blunt instrument inserted into it, outlining it on the outside wall of the stomach. The stomach is closed and the diverticulum resected at its base. The tip of the diverticulum usually requires freeing from surrounding structures in one case it was adherent to the tail of the pancreas and in the other to the upper medial aspect of the spleen.

Sarcoma of Stomach. Samuel F Marshall (Lahey Clinic) and William A. Meissner[2] (New England Deaconess Hosp) present a clinical analysis of 9 cases of leiomyosarcoma of the stomach and 32 cases of lymphoid tumors of the stomach. The leiomyosarcomas arose in the gastric muscularis and were most commonly located in the pyloric third of the stomach, the lymphoid tumors showed no predilection in location Hodgkin's disease and lymphosarcoma were the commonest types of lymphoid tumors Average age of the patients was 53 The symptoms were similar to those accompanying gastric carcinoma except that many patients were in good physical condition and did not show the cachexia and anemia common in carcinoma. Although there was no characteristic x ray picture, a filling defect with smooth margins, localized round smooth tumor, palpable tumor in a young person or multiple ulcers suggest gastric sarcoma.

The only treatment of value is radical surgery which, in tumors arising from lymphoid tissue, should be followed by deep x ray treatment. Survival five or more years after operation was recorded for 67 per cent of the patients with leiomyosarcoma In this group operations ranged from total gastrectomy to local excision depending on the type of lesion encountered. Of the patients with tumors of lymphoid origin, 56 per cent are alive and well. In 12 the postoperative period has been five years or longer, and 5 of these had Hodgkin's disease 6 patients are alive and well six months to two years postoperatively In the whole series 44 per cent of the patients have survived five years or more, a much higher survival rate than in carcinoma of the stomach.

Gastrostomy Review of 46 Cases treated during 1937-47 is presented by David Lyall and Harold J Leider[3] (Cornell Univ) The "tubular" type (Stamm's or Witzel's procedure) was performed in 23 patients About two thirds of the others were treated by various tubulovalvular "plastic" technics (Janeway's, Beck-Jianu's or Glassman's) Most patients had malignant disease principally of the esophagus, which necessitated gastrostomy palliatively In the others, gastrostomy was considered temporary or preparatory for further definitive surgery Over all operative mortality was 34 8 per

(2) Ann. Surg 131 824-837 June 1950
(3) New York State J Med. 50 1371 1372 June, 1950

cent. Mortality was 21 7 per cent in those treated with tubular gastrostomy In those treated by plastic gastrostomy, it was 47 6 per cent

The physical status of most patients was poor, and a large proportion were almost moribund at operation Postoperatively, wound sepsis was the commonest complication, but pneumonia, cardiac failure and coronary thrombosis often occurred. Contrary to the general impression, wound infection developed less often after tube gastrostomies than after the other type

The authors conclude that gastrostomy should not be done on a moribund patient with malignant disease, and that tubulovalvular gastrostomy is undesirable as a preliminary step to high esophagogastric anastomosis because it destroys potentially useful stomach. Since the various plastic technics require considerable skill the average surgeon may serve a patient better by using the simpler types of gastrostomy

Primary Carcinoma of Duodenum. Jerome Kleinerman, Krikor Yardumian (Pittsburgh) and H T Tamaki[4] (Philadelphia) report two cases and review the literature The incidence of primary carcinoma of the duodenum found at 483 695 autopsies was 0 035 per cent The duodenum was affected in about 45 per cent of cases of primary carcinoma of the small intestine Among 438 primary duodenal carcinomas, 22.5 per cent were suprapapillary, 59.2 per cent peripapillary and 18 3 per cent infrapapillary The difficulty in distinguishing primary tumors of the pancreatic or biliary system may account for the high percentage of primary peripapillary carcinomas

Carcinoma of the duodenum occurs in the late middle and advanced age groups. It is about three times more frequent in men than in women. It usually originates from anaplastic changes in the duodenal mucosa cylindric cell adenocarcinoma being the most common type Stenosing and polypoid lesions which infiltrate ulcerate and tend to encircle the lumen are common. Metastases are rare, usually occur late and involve regional lymph nodes, mesentery liver or lungs Symptoms may be due to obstruction of the intestinal or biliary tracts ulceration or penetration.

(4) Am. Int. Med. 32 451-465 March, 1950

erick Steigmann, Karl A. Meyer and Hans Popper[6] (Chicago) point out that, in general, when jaundice is present an increase in serum alkaline phosphatase in the absence of pathologic bone changes an increase in total serum cholesterol and a decrease in urinary and fecal urobilinogen must be regarded as evidence of severe interference with bile flow These findings may be temporary or prolonged. Such cases present a diagnostic problem because it is difficult to differentiate this condition from surgical conditions in which there is damage to hepatic cells in addition to signs of severe interference with bile flow

The authors studied (1) 65 cases of primary hepatitis (infectious or toxic) and cirrhosis in which examination had been done in the past five years and diagnosis established with reasonable certainty by the subsequent course, biopsy operation or autopsy, and (2) 46 cases of surgical jaundice in which laboratory tests disclosed damage to hepatic cells in addition to severe interference with bile flow Criteria for severe interference with bile flow were (*a*) serum alkaline phosphatase level over 15 Bodansky units, (*b*) total serum cholesterol level over 300 mg /100 cc., (*c*) less than 1 mg urobilinogen in a 24 hour specimen of urine or less than ½ unit in a 2 hour specimen and (*d*) less than 10 mg urobilinogen in 100 Gm stool.

Severe interference with bile flow was found in 28 5 per cent of the 65 cases of medical jaundice (primary hepatitis or cirrhosis) It is of interest that the incidence of this phenomenon varies in the different types of hepatitis. If the cases of infectious hepatitis, including homologous serum jaundice, are contrasted with those of toxic hepatitis, the incidence of the phenomenon is about identical, i.e., 41.8 against 43 5 per cent. However, if the patients with homologous serum jaundice are taken as a separate group, an unusually high incidence of the phenomenon is found, if conclusions can be drawn from this small group In contrast, patients with infectious (virus) hepatitis, which is transmitted by the oral route, show this phenomenon less often than those with toxic hepatitis. This points to a difference between virus hepatitis and homologous serum jaundice

(6) Arch. Surg. 59 101 112 July 1949

which is in keeping with the observation that the latter is as a rule the more severe disease In comparison with acute hepatitis the phenomenon is far less common in cirrhosis with jaundice

Impairment of hepatic function was more common and severe interference with bile flow less common with medical jaundice than with surgical jaundice The reaction to the cephalin-cholesterol flocculation test was far more often positive and the serum alkaline phosphatase and total cholesterol levels were less often markedly increased in the medical than in the surgical cases

A characteristic morphologic picture was present in ome cases of cirrhosis, namely, when there was an encir ling fibrosis obstructing the septal bile ducts, whereas in ises of acute hepatitis no correlation of severe interfer ence in bile flow with anatomic changes was found Severe interference with bile flow (usually considered a character istic of extrahepatic mechanical obstruction requiring sur gery) is highly significant in differential diagnosis of jaun dice

Experiences with Needle Biopsy of Liver John D Bonzer (Eugene, Ore) Thomas J White Harold M. Levy, Angelo Gnassi and H. Preston Price[7] (Jersey City Med. Center) obtained 400 liver biopsy specimens with the Vim-Silver man needle by the following method.

METHOD.—The biopsy specimens were obtained at the bedside without premedication. The subcostal approach was used when the liver was enlarged and palpable and the intercostal approach when it was not palpable. In the latter instance the sites were de termined by percussing the area of greatest liver dulness, and en trance was made in the anterior axillary or midaxillary line. Pro- thrombin, bleeding and clotting times were determined and any abnormalities corrected before attempting biopsy If ascites was present, paracentesis was done before biopsy

The skin was prepared with iodine and alcohol, and the skin, subcutaneous tissue, muscle and peritoneum were anesthetized with 1 per cent procaine solution. An 0.3 cm. skin incision was made and the biopsy needle introduced through the anesthetized tract to just inside the liver capsule. The patients were allowed to breathe quietly during the procedure to avoid marked motion of the needle in those unable to hold their breath in expiration. Slower and more meticulous manipulation of the needle was possible with this tech

(7) Northwest Med. 49 248-249 May 1950

nic, thereby increasing safety and the number of successful biopsies. The stilet of the needle was removed and the split inner needle inserted to its full depth. The outer needle was advanced over the inner one with a rotary motion, the inner needle being held stationary. Finally, the outer needle was turned and both needles withdrawn simultaneously. The specimen was placed in 10 per cent Formalin and treated in the usual fashion for microscopic examination.

Contraindications to the procedure are abnormalities in blood coagulation, suspected liver abscess, sepsis, acute heart failure and severe debilitation.

Of the 400 biopsy specimens, 135 were interpreted as normal and 150 showed portal cirrhosis, 50 fatty livers, 30 carcinoma, 16 biliary stasis, 4 virus hepatitis, 5 lymphoblastoma, 4 multiple nodular hyperplasia, 3 liver abscesses, and each amyloidosis, central necrosis or cholangitis. Excretory function abnormalities, as shown by bromsulfalein retention, serum bilirubin, alkaline phosphatase, retention of urinary bile or total serum cholesterol elevation, were found in all patients with biliary stasis, 85 per cent with cirrhosis, 80 per cent with fatty livers, 60 per cent with hepatitis and 58 per cent with malignancy. Metabolic function abnormalities, as shown by protein partition changes, positive cephalin flocculation tests, positive thymol turbidity, *cholesterol partition changes or carbohydrate* intolerance were found in all patients with hepatitis, 70 per cent with cirrhosis, 60 per cent with fatty livers, 20 per cent with malignancy and 25 per cent with biliary obstruction.

Needle biopsy is only safe when the correct technic and proper precautions are used. Complications in this series included a pneumothorax which subsided without ill effect, variable degrees of pain, introduction of the biopsy needle into a distended gallbladder necessitating laparotomy and one death from hemorrhage.

Possibilities of Hepatectomy in Treatment of Liver Tumors. J. Sénèque and R. Aurousseau[8] (Paris) report three cases in which they performed partial hepatectomy: (1) cavernous angioma of the left lobe of the liver with cure, (2) trabecular and alveolar epithelioma of the right lobe with five year cure, and (3) trabecular epithelioma of the right lobe with recurrence six months later.

(8) J. de chir. 66: 22 36, January 1950

Experiments on dogs have shown that 60 70 per cent of the liver can be removed at the same operation without causing grave disturbances Absence of such disturbances is explained by rapid regeneration of the parenchyma from remnants of liver tissue by formation of new lobules, due principally to proliferation of the streaks of hepatic cells. In eight weeks it is impossible to distinguish old from new lobules However regeneration is possible only if vascularization of the remaining portion of the liver is not compromised Results of hepatectomy in man have confirmed these experimental findings.

All American authors agree that during exploratory laparotomy it is imperative that a biopsy specimen of liver be obtained and examined immediately Two technics may be used (1) trocar puncture and aspiration, and (2) removal of an oriented fragment with the electric knife after previous insertion of hemostatic sutures, followed by suture of the cut portion with use of thrombin sponges if necessary

Hemostasis must always be kept in mind preventive hemostasis to avoid hemorrhage of the large vessels during operation hemostasis during operation by cutting the tissue with a sharp and weakly coagulating electric knife, and hemostasis after section by (1) direct ligature of the large vessels even if they do not bleed and (2) suture of the cut surface if possible or application of an epiploic graft or a gelatin sponge soaked with thrombin if suture is not feasible Blood loss during and after operation must be replaced by citrated blood Infection is prevented by use of antibiotics Respiratory complications are avoided by improvements in anesthesia tracheal aspiration and respiratory exercises Ileus and hematemesis are eliminated by avoiding any compression of the portal vein and by use of Wangensteen suction

Three forms of postoperative disturbances of metabolism have been thoroughly studied by American authors (1) liver death, which is rare and for which there is no treatment hence the importance of preventive treatment (2) hepatic shock, which is combated by small blood transfusions, plasma alkali and glucose solutions ascorbic acid cortin and liver extracts, and (3) a syndrome of progressive denutrition ending in cachexia.

In 80 partial hepatectomies and lobectomies for angioma there were two operative deaths and one late recurrence. Five partial hepatectomies for solitary cyst resulted in five surgical cures Nine partial hepatectomies for benign adenoma resulted in nine surgical cures, with one death five years after recurrence

Morbidity and Mortality in Ruptured Liver Stanley Mikal and George W Papen[9] (Tufts College) reviewed results of treatment in 40 patients with subcutaneous or non penetrating liver injuries. About two thirds of the ruptured livers were due to automobile accidents Total mortality regardless of type of treatment was 62.5 per cent.

Despite the fact that all patients appeared to be out of shock when operated on, mortality was highest when surgery was performed 3-12 hours after admission. Surgery within the first 3 hours after hospitalization was associated with a mortality of 33 3 per cent and after 3 hours, with a mortality of 66 per cent, after 12 hours the rate dropped to zero a result partially attributable to adequate transfusions to combat shock smaller size of liver lacerations and control of hepatic bleeding by adequate clot formation.

The right lobe of the liver was lacerated 4.67 times more frequently than the left, and the superior and inferior surfaces were lacerated with equal frequency Either operatively or by autopsy the kidneys were found injured in 20 per cent of cases the spleen in 10 per cent and the lungs in 17 5 per cent Ribs were broken in 37.5 per cent and other bones fractured in over 50 per cent

In 7 cases operative treatment consisted in sucking out all the blood from the peritoneal cavity and either packing the liver laceration with gauze suturing the lacerated liver or packing the laceration with muscle The mortality was 38 9 per cent, the commonest cause of death being hemorrhagic shock In four recently treated cases whole blood was administered for shock, operation performed early liver laceration packed with Oxycel or Gelfoam and the abdomen closed without drainage By these procedures the operative mortality was reduced to zero

(9) Surgery 27 520 525 April, 1950

Splenectomy in Blood Dyscrasias C Stuart Welch and William Dameshek[1] (Tufts College) report results in 220 cases (table)

In congenital spherocytosis good results should be obtained in all cases if accessory spleens are removed at operation Splenectomy is done during the crisis if the fulminating process is not alleviated by a few blood transfusions. The patient is prepared with transfusion, fluids, etc., before operation

In acquired hemolytic anemia splenectomy should be done only after careful study and if medical measures have failed. Useful criteria for establishing a diagnosis of the primary type include reticulocytosis, spherocytosis normoblastic hyperplasia of bone marrow increased serum bilirubin, increased output of fecal urobilinogen circulating antibodies at 37 C in saline or albumin, positive Coombs test and greatly diminished survival time of transfused normal red cells. In certain cases of the secondary or symptomatic type the increased hemolytic activity of the spleen may be relieved by splenectomy Results in patients with leukemia or Hodgkin's disease were unsatisfactory

Primary or idiopathic thrombocytopenia purpura usually responds to splenectomy but purpura of chemical,

RESULTS OF SPLENECTOMY IN 220 CASES OF BLOOD DYSCRASIAS

CLASSIFICATION	CASES	GOOD RESULTS %
Hemolytic anemias		
Congenital spherocytic anemia	38	100
Acquired hemolytic anemia		
Primary	34	50
Secondary	18	33
Hypersplenism with cytopenias		
Thrombocytopenic purpura (idiopathic)	92	61-80
Splenic pancytopenia and neutropenia		
Primary	20	81
Secondary	14	71
"Splenism"		
Hypoplastic anemia	4	50

(1) New England J Med. 242 601-606 Apr 20 1950

allergic or leukemic origin does not respond and may be made worse Care must be taken to establish a correct diagnosis. A search must be made for accessory splenic tissue Splenectomy should be delayed in children since spontaneous remissions are frequent. In adults with active bleeding from mucous membranes, delay may be fatal because of the danger of cerebral hemorrhage

Pancytopenia or hypersplenism is much more frequent than neutropenia alone When these disorders are primary or seem to be of splenic origin, results of splenectomy are better than when hypersplenism is secondary to other diseases. In cases of supposed hypersplenism with cytopenias, bone marrow must be normal or preferably hyperplastic if a good result is to be obtained with splenectomy Diseases such as aleukemic leukemia, myelosclerosis with splenic myeloid metaplasia and lymphoma should be ruled out.

"Splenism" designates the disorder in which the normal inhibitory action of the spleen on the bone marrow is probably deleterious Indications for splenectomy are not definitely established, but, in exception to the general rule, it may be performed in absence of hyperplastic bone marrow

An important technical consideration in splenectomy is careful detachment of the stomach from the spleen to avoid injury to the stomach. Preliminary ligation of the splenic artery near its origin is a useful step in difficult cases, particularly when a large spleen adherent to the diaphragm must be removed. The extension of any sort of left-sided abdominal incision through the ninth or tenth intercostal space with or without resection of a rib is an excellent approach for removal of a large spleen firmly attached to the diaphragm and parietes The transthoracic approach is undesirable because it does not permit careful exploration of the abdomen for accessory spleens or associated lesions which might have some relation to hypersplenism nor can cholecystectomy be performed at the same time as splenectomy in congenital spherocytosis with gallstones. Patients should be carefully selected and given adequate preoperative preparation by an internist. Fresh blood transfusions are desirable, and in some cases washed red cell transfusions are needed. Postsplenectomy venous thrombosis is uncommon, despite the appearance of great numbers of platelets, and the use of anticoagulants has rarely been necessary

Hypersplenism Associated with Follicular Lymphoblastoma Report of Case with Splenectomy is made by Lawrence Berman Alfred A. Klein, Herman J Linn and Gaylord S Bates[2] (Wayne Univ) The peripheral blood showed neutropenia and thrombocytopenia and marrow examination indicated hyperplasia of elements deficient in the blood thus satisfying an important criterion for diagnosis of hypersplenism Purpura was of sufficient severity to require splenectomy after which purpura ceased and thrombocytopenia disappeared, but the severe neutropenia persisted even though the marrow reverted to normal It is difficult to explain this dissociation on the basis of current widely accepted concepts of the mechanism of the splenic effects in hypersplenism.

Sections of the spleen showed a slight increase in eosinophil and neutrophil granulocytes, but disintegrating platelets and cytolytic foci could not be identified There were some disintegrating cells and platelets were lying free in the pulp and sinusoids or superimposed on or phagocytosed by both reticulum and large lymphoid cells In this case platelets were probably removed from the blood circulating through the spleen, as there was no evidence of their formation in that organ

Since accumulation of platelets is characteristic of spleens in various disorders other than thrombocytopenia the phagocytic or sequestration theory is probably not a satisfactory explanation of peripheral deficit of platelets The conflicting views on this subject may result from the operation of several factors to varying degrees in different cases The authors see no reason for considering the phagocytic or sequestration theory as exclusive of the concept of a hormonal or humoral mechanism of production of thrombocytopenia in hypersplenic disorders

Splenic Artery Ligation in Palliation of Ascites Robert M Moore Albert O Singleton, Jr., and W H. Picketts[3] (Univ of Texas) report that six patients with advanced cirrhosis, wasting ascites and splenomegaly tolerated division of the splenic artery between ligatures although they were poor operative risks from the standpoint of liver func

(2) Blood 5:286-292, March, 1950
(3) Ann. Surg. 131:774-80 May 1950

tion There was immediate and striking remission of ascites, lasting 12 months in one case and still present at 10 and 17 months in two, in the other three cases improvement was less spectacular Spontaneous remission, particularly in less advanced stages of cirrhosis, may account for much of the apparent benefit from therapeutic measures.

The splenic artery may carry as much as 40 per cent of abdominal arterial blood Definite advantages of splenic artery ligation over splenectomy are that it requires less time and leaves intact most of the collateral venous channels about the splenic capsule The splenic artery may be approached through a left oblique subcostal incision, dividing part of the gastrocolic omentum. Because of the tortuosity of the arterial trunk it should be divided and each end ligated doubly, one of the ligatures transfixing the vessel before it is divided. In three cases splenic artery ligation caused an immediate fall of 20 per cent or more in portal pressure

Discussion of Various Surgical Procedures Used in Management of Portal Hypertension Jere W Lord, Jr[4] (New York Univ) states that portal hypertension may be due to intrahepatic block, principally caused by liver cirrhosis, or extrahepatic block of the portal or splenic vein, usually caused by thrombosis. The two important clinical manifestations of portal hypertension are ascites and hemorrhage from esophageal varices. The latter may be treated by internal tamponade with a balloon on a Levin tube or by injections of sclerosing solution into the esophageal veins

Eleven operative procedures have been used in an attempt to control one or both of the clinical manifestations of portal hypertension (1) The Talma Morison operation of bringing the omentum in contact with the rectus muscle to develop another route for collateral circulation. (2) Splenectomy alone (3) Simple ligation of the splenic artery (4) For intractable ascites due to liver cirrhosis in patients without esophageal varices, the button operation modified by including removal of a segment of fascia. (5) An operation done in a case of ascites associated with repeated massive hemorrhage in which a splenorenal shunt was attempted

(4) New York State J Med. 49 2044 2049 Sept. 1 1949

but multiple injury to the splenic vein after splenectomy required ligation of the stump of the vein The vessels along the lesser curvature of the stomach were divided from the esophageal junction to the antrum then the omentum was joined to the left rectus muscle (6) Total gastrectomy for serious postsplenectomy bleeding (7) Resection of the lower end of the esophagus and cardiac end of the stomach followed by esophagogastrostomy for postsplenectomy bleeders on the basis of extrahepatic block (8) Som and Garlock's operation to form adhesions between the esophagus and mediastinum by packing in case of repeated massive hemorrhages from esophageal varices (9) Splenectomy followed by anastomosis between the splenic and left renal veins (10) Portacaval anastomosis. (11) A third group of venous shunting procedures reported by Blakemore and Linton in patients who have not obtained relief from episodes of hemorrhage after splenectomy

The successful application of these surgical procedures rests on the foundation of the important physiopathologic studies carried out on the liver during the past decade The following factors are of value high protein diet high caloric intake with liberal amounts of whole B complex supplements of fat large amounts liver by mouth and crude liver extract intramuscularly concentrated serum albumin for ascites and also when indicated ammonium chloride orally and mercuzanthin* intravenously low salt diet with unrestricted water intake total abstinence from alcohol, and adequate rest This regimen has greatly improved the prognosis of uncomplicated liver cirrhosis

Nonobstructive Lateral Portal Vein Vena Cava Anastomosis Clinical Application of Smith Freeman Clamp Ormand C Julian and William Metcalf[5] (Chicago) sought to overcome the disadvantages of direct anastomosis through use of the Smith Freeman clamp which was developed for Eck fistula studies in animals but provides a means by which a side to-side shunt between portal vein and vena cava may be made without obstructing either Some of the difficulty encountered because of the vein plexus in the

(5) Arch. Surg. 59 432 436 September 1949

hepatoduodenal ligament may be avoided because only the dorsal aspect of the portal vein need be exposed. The line of anastomosis is selected where the two veins are in closest relationship and is demarcated by holding sutures at each end passed through all coats of both vessels and tied (Fig 129, *A*) By careful traction on the stay sutures and compression of the vessels, the clamp is passed down over the area of

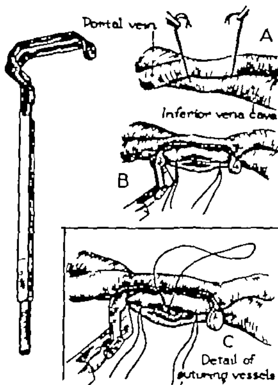


Fig. 129 —Construction of side-to-side portal vein-vena cava anastomosis with use of Freeman clamp (left) *A* holding suture t mark site of anastomosis *B* clamp in place and incisions made, *C* placement of simple continuous suture. (Courtesy of Julian, O C., and Metcalf W Arch. Surg. 59 432-436 September 1949)

intended anastomosis and tightly closed The adjacent folds of vein are then opened longitudinally in the stay sutures and slightly medial to the apex of the fold (*B*) The clamp in its present form does not provide room for an everting suture, so a simple continuous suture has been used (*C*)

The authors used this method in one case, with satisfactory results This anastomosis has certain advantages over the less direct splenorenal type A greater volume of blood flow can be obtained depending only on length of the

anastomosis made. Avoidance of obstruction of the veins during operation, particularly of the portal vein, is a theoretical advantage in that it may reduce the incidence of postoperative mesenteric thrombosis. The advantage accruing from use of the clamp is increased by the fact that the portal vein is only partially exposed. The disadvantages are that an everting mattress suture cannot be placed with the present clamp and that the surgeon is left without safety devices if the clamp should fail mechanically. Slipping of the clamp has not been a factor, and the superior construction of the one now in use makes breakage or stripping of threads most unlikely.

BILIARY TRACT

Chronic Cholecystitis Produced by Division of Sphincter of Oddi. Using a transduodenal approach, S. H. Gray, J. G. Probstein and Leo A. Sachar[6] (Washington Univ.) divided the sphincter of Oddi and a portion of the intramural wall of the common duct in 10 dogs. This permitted duodenal contents to regurgitate as high as the gallbladder. In two dogs the preoperative diastase content was 0 and 150 units. Postoperatively the bile diastase level was usually more than preoperatively and varied between 0 and 4,700 units. Further evidence of regurgitation of duodenal contents was the finding of hair in one dog's gallbladder.

Operation was followed by chronic inflammatory changes in the gallbladder and common duct, most pronounced when the duodenal reflux was greatest, as shown by higher diastase concentrations in bile. Hepatitis resulted in three dogs. Inflammatory changes may have been due to activated pancreatic enzymes, bacteria or both.

These observations suggest that some cases of chronic cholecystitis in man may be due to an incompetent sphincter mechanism at the opening of the common duct into the duodenum. In cases of recurrent pancreatitis in man, division of the sphincter of Oddi should be approached with caution.

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(6) Arch. Surg. 59: 1007-1014, November, 1949.

Anatomy of Nerves Supplying Common Duct and Proximal Duodenum. In dissections made on 15 recently killed *dogs and 20 human cadavers, Henry P Royster, Alexander M. Sloan*, Lillian L McCain and Theodore Shohl[7] (Univ of Pennsylvania) traced the vagus nerves from the neck to their abdominal endings, and the sympathetic trunks from the thorax to the celiac ganglions and further along *their abdominal distribution. Particular attention was paid* to the nerves directed toward the biliary tract and proximal duodenum. These studies confirmed the reports of others. There is little difference between man and dog in the abdominal distribution of the autonomic nerves, and that difference is quantitative, for the size and number of nerve trunks in man are much greater

In summary, the following autonomic nerves supply the biliary tract and proximal duodenum (Fig 130) (1) Unmixed vagal fibers Their sources are the constant branches *of the left vagus to the porta hepatis and an inconstant* branch from the same nerve crossing directly through the anterior leaf of the gastrohepatic omentum to the lower portion of the biliary tract. (2) Mixed vagus and sympathetic fibers. These make up by far the greater part of the autonomic nerve supply to this area They arise from both celiac ganglions (which are joined by the celiac plexus) and reach the common duct region along the hepatic artery and by way of the hepatoduodenal ligament. The components of this mixture are chiefly filaments from the right vagus, with a small number of left vagus fibers combined with large numbers of sympathetic fibers from the dorsal chains and greater and lesser splanchnic nerves, and filaments direct from both vagi that merge with periarterial sympathetics along the celiac axis.

The following points are emphasized Except for two branches coming directly from the vagi, the sympathetic and parasympathetic nerves follow common pathways in their course to the biliary tract and proximal duodenum There is free anastomosis between the right and left-sided nerve trunks of both systems Interruption of vagus nerve fibers must be done at the *diaphragmatic level in the case*

(7) Surgery 26 412-420 September 1949

of the sympathetics, the splanchnics, celiac ganglions and possibly the dorsal chains must be severed or ablated In operations for upper abdominal pain, especially biliary dyskinesia the ineffectiveness of random sectioning of vagus nerve trunks in the subhepatic area is demonstrated Operations on the sympathetic system in the upper abdomen

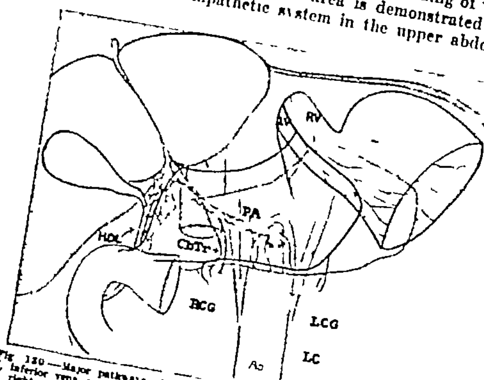


Fig 120.—Major pathways of vagus and sympathetic systems in upper abdomen. *VC* inferior vena cava; *Ao* abdominal aorta, *LV*, left vagus nerve at diaphragm; *RV* right vagus nerve at diaphragm *LCG* left celiac ganglion receiving greater and lesser splanchnics from above and branch from lumbar chain; *RCG* right celiac ganglion with connections as on left, ganglions joined by filaments of celiac plexus *PA*, periarterial sympathetics of hepatic artery *CbTr* combined trunks of vagus and sympathetic fibers from right celiac ganglion en route to biliary tract via hepatic artery; *HDL*, hepatoduodenal ligament area containing anastomosing nerve trunks; *LC* lumbar chain. (Courtesy of Royster H. P., et al Surgery 26:413-420 September 1949)

for clinical and experimental purposes are necessarily accompanied by interruption of some vagus fibers and the results should be so interpreted

The nomenclature should be clarified by replacing descriptive terms such as nervi choledochi et pancreatici by others denoting their sympathetic and parasympathetic components, such as autonomic nerves or mixed sympathetic and vagus nerves to the biliary tract and proximal duodenum

Comparison of Pain Produced Experimentally in Lower Esophagus, Common Bile Duct and Upper Small Intestine with Pain Experienced by Patients with Diseases of Biliary Tract and Pancreas William P Chapman, Rudolfo Herrera and Chester M Jones[8] (*Boston*) induced experimental pain in seven patients with biliary tract disease and two with pancreatitis by balloon distention of the lower portion of the esophagus the common bile duct and the upper part of the small intestine Results were compared with the clinical pain in these patients (Figs 131 and 132)

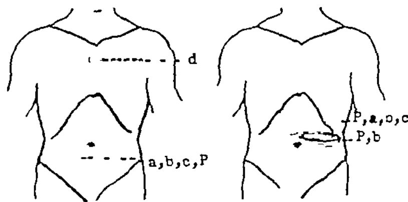


Fig 131 (left) —Common duct stimulation and distention of upper small intestine produced deep-seated, colicky pain in right-sided midabdominal areas *a*, *b* *c* similar to clinical pain *P* Lower esophageal distention produced deep-seated burning pain in substernal area *d*.

Fig 132 (right) —Deep-seated, sharp clinical pain *P* rising in right upper quadrant and epigastrium (areas *a* *b*, *c*) and radiating to upper left quadrant and around left side to back, was reproduced only by duodenal stimulation. Common duct distention produced *similar pain but without radiation. Lower esophageal stimulation* produced deep-seated, burning pain also without radiation.

(Courtesy of Chapman, W P., *et al* Surg. Gynec. & Obst. 89 572 582 November 1949)

Distention of the duodenum or jejunum and of the common bile duct produced identical pain in seven patients. In the other two the difference was one of radiation only Distention of the lower esophagus produced a less striking similarity of pain, but five patients felt that pain produced from the common duct and lower esophagus was indistinguishable. Pain induced by lower esophageal distention was the same as that produced in the upper small intestine of three patients and was different in six. Pain from stimulation of all three areas was the same in three patients but not comparable in six.

(8) Surg G nec & Obst. 89 572 582 November 1949

Distention of the common duct and of the upper small intestine reproduced clinical pain in seven patients. The experimental and clinical pain were similar as to quality, location and radiation. The similarity of the pain from the viscera studied may be due to a common sensory supply, the great splanchnic and lower thoracic sympathetic nerves.

[These experiments confirm the generally accepted idea that the pain associated with common duct stone is due to distention of the duct.—Ed.]

Acute Cholecystitis. Guy Blackburn[9] (Guy's Hosp., London) reports the presence of cholelithiasis in 25 of 26 cases of acute cholecystitis. This finding lends support to the concept that acute inflammation of the gallbladder follows acute obstruction which may cause increased intravisceral tension, interference with the blood supply, gangrene, perforation and peritonitis. Bacterial invasion is a secondary phenomenon and in eight cases neither aerobic nor anaerobic organisms could be grown from the wall or contents of the gallbladder.

Most important of all aids in treatment is awareness that gallstones should be removed to avoid complications such as acute cholecystitis. Operation is less hazardous than expectant treatment because of improved methods of blood transfusion and administration of intravenous fluids, chemotherapy and antibiotics, advances in anesthesia, controlled vitamin K therapy for jaundiced patients and substances such as fibrin foam to control liver oozing. Cholecystostomy should be reserved for patients too ill for cholecystectomy and particularly those with jaundice attributed to stones in the common duct. Subsequent cholecystectomy with choledocholithotomy is less hazardous than at the primary operation. In the 26 consecutive cases cholecystectomy was possible, with common duct explorations in 8. Convalescence was uneventful in all but a patient with a perforated gallbladder who had wound dehiscence eight days after cholecystectomy.

Acute Gangrenous Cholecystitis. William J. Clifford[1] (Boston City Hosp.) reports 100 cases, 54 in women and 46 in men. This sex distribution is in marked contrast to that in acute cholecystitis, which occurs five times more

(9) Practitioner 164:254-257, March, 1950.
(1) New England J. Med. 241:640-643, Oct. 27, 1949.

frequently in women Most patients were over age 50 and 90 had a history of chronic gallbladder disease

Gangrene of the gallbladder follows interference with the blood supply and lymphatic drainage resulting from increased intravisceral tension produced by acute obstruction. The chief complaint is usually pain in the right upper quadrant, often with nausea and vomiting Tenderness and a mass may be found at the same location Elevated temperature, pulse and white cell count are frequent Varying degrees of distention were noted in 27 patients, but there were only 4 with proved gallstone ileus. Jaundice is of little diagnostic significance There was evidence of perforation in 85 patients In 23 there was generalized and in 62 localized peritonitis Stones were present in 89

Over all mortality was 34 per cent Operative mortality in 92 cases was 28.2 per cent Operation was not performed on eight patients, and all died three refused surgery and most of the others were beyond its help when first seen. Mortality (10 6 per cent) was lowest in 47 patients operated on in the first 48 hours of illness In groups operated on during later periods, mortality was 20-50 per cent.

When possible cholecystectomy should be performed, however if the patient's general condition will not tolerate this procedure cholecystostomy may be done Early preoperative preparation, proper anesthesia, quick and gentle surgery and careful postoperative care by surgeon and internist lowers mortality substantially It should be realized that gallstones are never benign and that gallbladders containing them should be removed promptly before complications ensue

Gangrenous Perforation of Gallbladder Willis G Diffenbaugh, *Francis E Sarver and E. Lee Strohl*[2] *analyzed* 19 cases found at operation from 1928 to 1949 at St. Luke's Hospital, Chicago where during the same period 1 127 gallbladder operations were performed, an incidence of 1.69 per cent. Seventy five operations (6 65 per cent) were for histologically confirmed acute cholecystitis and disclosed perforated gallbladders in 25.33 per cent Of the 19 perforated gallbladders, 7 were of Niemeier type 1 (acute

(2) Arch. Surg 59 742 749 September 1949

free perforation) and 12 were associated with pericholecystic abscess (Niemeier type 2)

The youngest patient was 29 the oldest 79 (average 57.2) Ten patients were women Sixteen perforations occurred between 12 and 72 hours after onset of symptoms and in three between 3 and 6 days Of 16 patients who had a history of gallbladder disease, 11 had had it from 2 to over 10 years Three had no such history

There were no distinctive signs, symptoms or laboratory findings to establish the diagnosis of impending or actual perforation Localized pain and tenderness in the right upper quadrant with a localized mass associated with clinical and laboratory evidence of persistence or progression of the process, indicated the diagnosis in most instances

In 11 cases the gallbladder was removed in 2 stones were found in the common duct and drainage of the duct was instituted at the time of cholecystectomy, in 1, the appendix was also removed In eight cases the gallbladder was drained in one stones were found in the common duct and drainage was instituted Average hospital stay of the 15 patients who recovered was 31.5 days

There were four deaths, two for each Niemeier type of perforation. Three deaths resulted from progression of sepsis secondary to the perforation the fourth followed acute coronary occlusion the fifth postoperative day

In view of the frequency of gangrenous perforation in acute cholecystitis and its high mortality, the authors conclude that operation should be done when there is evidence of progression of the cholecystitis during the first 48 hours after onset of symptoms

Studies in Acute Cholecystitis Cholecystostomy, Indications and Technic Frederick P Ross and J Englebert Dunphy[3] (Harvard Univ) feel that cholecystostomy at times is a lifesaving procedure to be carried out as a planned operation under local anesthesia and not reserved merely as an escape from a technically difficult situation. Of 134 patients with acute cholecystitis operated on at Peter Bent Brigham Hospital (1941-47) 20 (14.9 per cent) were treated by cholecystostomy 2 of this group had a

(3) New England J Med. 242 359 364 Mar 9 1950

second cholecystostomy for recurrent acute cholecystitis after 18 months and 4 years There were two deaths (10 per cent) In 5 cases the operation was resorted to because of a difficult condition, in the other 15 it was used as a planned procedure because of the severity of illness or a serious intercurrent disease The high mortality is attributed to the gravity of the disease and should not be interpreted as indication of inadequacy of the procedure The patients who died could not have been saved by cholecystectomy

Specific indications for cholecystostomy are decompensated heart disease, diabetes and other severe intercurrent disease A less precisely defined but equally important group of indications comprises moderate illness and toxicity on admission but rapid deterioration despite supportive therapy in the hospital Age itself is not an indication for cholecystostomy but a potent secondary factor in decision.

Cholecystostomy should be regarded as the first stage of a two stage cholecystectomy and is essential for the patient's permanent well being Occasionally advanced age and concomitant diseases necessitate indefinite postponement of cholecystectomy provided no cystic or common duct obstruction has been demonstrated by cholecystocholangiography The time at which definitive surgery is done varies with the degree of local inflammation at operation and the need for improvement in the patient's general condition. *One month after the first stage is a reasonable time of election for the definitive operation.* Occasionally it can be done in two weeks rarely longer than a month is required

Of the 20 patients who had cholecystostomy 12 had subsequent cholecystectomy and in 6 of these the common duct was explored. Four of the eight patients who had cholecystostomy alone remained well for four years in two no follow up data were available of the remaining two who developed recurrent acute cholecystitis and were again cholecystostomized, one died of coronary thrombosis and the other of pulmonary embolism after an uneventful convalescence If definitive surgery is postponed, the patient's chances of remaining free from subsequent attacks for several years seem to be about 50 per cent.

[This article and the three preceding ones bring up point that will probably always be controversial. The first involves the question of the definition of acute cholecystitis. What some writers mean by this term differs from the conception of others. Other points concern the indications for cholecystostomy. There is no doubt that this procedure has a definite place in some cases and may be lifesaving. Some surgeons probably resort to it too often and others not often enough. Certainly in the poor risk case a two stage cholecystectomy as mentioned by Ross and Dunphy will often result in a live patient with a good result instead of an operative death. Of course any stones present in the gallbladder should be removed at the time of the cholecystostomy.—Ed.]

Surgical Treatment of Gallstones and Their Complications

Samuel F Marshall[4] (Boston) states that over-all mortality in gallbladder surgery at Lahey Clinic has gradually been reduced from 4 76 per cent during 1910-29 to 1 1 per cent during 1942-48 Surgical treatment of the biliary tract consists largely of treatment of diseases of the gall bladder and its complications, which is cholecystectomy as soon as diagnosis is established Operative mortality with cholecystectomy during 1942-45 in 1 104 patients was 0 9 per cent during 1946-48 there were 1 019 operations on the biliary tract with a mortality of 1 47 per cent but 12 of the 15 deaths occurred in patients with serious complications resulting from long standing gallstones

Gallstones occur more often than is generally admitted and their incidence increases with age They are more common in women than in men in the 1 104 patients operated on during 1942-45 the proportion was 3 1 The youngest patient was aged 9 and the oldest 81 and there was a higher incidence in obese persons Stones are found in 90-95 per cent of chronically infected gallbladders, and in most cases diagnosis is easily made by cholecystography Nonvisualization of the gallbladder in a patient with a typical history means chronic cholecystitis and in 95 per cent of these cholelithiasis also

Complications of untreated calculous gallbladder are listed in relative order of their frequency common duct stones, acute cholecystitis, cholangitis hepatitis and acute or chronically recurrent pancreatitis Some of the more uncommon complications are hydrops of the gallbladder and cancer arising primarily in the gallbladder various internal biliary fistulas resulting from perforation of the

(4) Texas State J Med. 46 12 17 January 1950

gallbladder and the much less common complication of intestinal obstruction due to gallstones.

One of the most serious complications of gallbladder surgery is stricture of the common duct. In 84 per cent of 234 cases, stricture was due to operative trauma. Among 227 patients operated on for benign stricture, there were 27 hospital deaths (11 per cent), however, 139 such patients have been operated on since 1943 with 12 deaths (8 6 per cent) Treatment of these strictures is complicated and is in general unsatisfactory from the standpoint of surgical correction. Most of these patients had had repeated operations to correct stenosis and obstruction to bile flow and many have pronounced changes in the liver with serious reduction of function They constitute a high risk surgical group The most satisfactory method of operation consists of preservation of the sphincter of Oddi with a direct mucosa to mucosa anastomosis of the severed ends of the duct over a rubber T tube

Indications for and Results Following Exploration of Common Bile Ducts for Stones The following symptoms, singly or in combination, have been considered by Leland S McKittrick and Norman J Wilson[5] (Brookline, Mass.) as suggestive of common duct stones jaundice usually following pain chills and fever (recurrent) frequent attacks of pain at intervals of 14 days or less The authors' custom is to explore the common duct if, in addition, one or more of the following conditions is found at operation small stones and dilated cystic duct dilated common duct, no stones in the gallbladder when a history of gallstone attacks was definite

In the 5½ years ending Dec 31 1946, 100 consecutive primary operations involving the common duct were carried out. Seventy-eight per cent of the patients were women 80 per cent were 50 or over and 14 per cent were between 70 and 82 40 per cent had one or more complicating systemic conditions. The operation of choice, cholecystectomy and choledochostomy, was performed in 95 patients cholecystostomy was done in 4 because of technical difficulties, poor condition of the patient, or a combination of these

(5) California Med. 71 132 137 August, 1949

factors In the other patient the gallbladder was not removed but was used to repair a large defect in the common duct due to erosion from a large stone Local complications, secondary to or associated with biliary tract disease, were present in 29 patients pancreatitis, subacute (in 7) or chronic (in 3), was the commonest complication There were 13 postoperative complications but no deaths, 4 of the complications were directly referable to the operation Stones were found at operation in 96 per cent of the patients gallbladder only, 44 common duct only, 4 gallbladder and common duct, 48

All patients left the hospital apparently in satisfactory condition Ten subsequently died of unrelated causes, six were lost to follow up Of the remaining 84 75 (89 per cent) were relieved of all symptoms 6 had mild residual fulness or distress after ingestion of certain foods and are considered as having a good result For three patients the results were unsatisfactory Cholangiograms taken before removal of the T tube showed residual stones in two the stones were subsequently passed and both patients are in good condition. In the remaining patient who had been operated on for persistent, intense pain no stones were found at operation, but one year later a duodenal ulcer was demonstrated by roentgen studies

Physiologic Studies in Cases of Stricture of Common Bile Duct From an analysis of 186 cases of stricture of the extrahepatic ducts in which he operated, Waltman Walters[6] (Mayo Clinic) found evidence of the beneficial effects of liver function studies and of pre and postoperative treatment aimed at compensating for disturbances resulting from the biliary obstruction. Prevention of bleeding was accomplished by administration of vitamin K and blood. As a result, the syndrome of hepatorenal insufficiency did not occur When a more diligent search for both ends of the duct beyond the stricture was instituted, a greater percentage of cases was found in which anastomosis of duct to duct or duct to duodenum could be accomplished. As a result of this routine a mortality of 10.2 per cent in 98 patients operated on from 1924 to 1939 was reduced to 3 4

(6) Ann Surg 130 448-454 September 1949

per cent in 88 operated on from 1940 to 1948 If the mortality in the latter group is figured on the basis of operative procedures, including reoperations for recurrence, it is only 2 6 per cent

Evidence accumulated during these years indicates that after a biliary-duodenal anastomosis reflux of food, barium or air into the common and hepatic ducts is not responsible for pain, fever and jaundice but that these symptoms are the result of recurring obstruction of varying degree at the site of the previously made anastomosis

To prevent contracture of a circular biliary ductal anastomosis, a rubber catheter extending from the hepatic duct into the duodenum may be used as a splint. The catheter can be kept in position by a silk suture passing through it and brought out to the skin where it is anchored to a button. When other short tubes even of Vitallium, are placed within the duct, their lumen will become plugged and obstructed by bile, and bile will accumulate about them. These foreign bodies will obstruct the common duct unless removed for they will not pass through the sphincter of Oddi Hence they should not be used Prostheses of any type used to prevent contracture in anastomosis of duct to intestine will likewise become obstructive agents if they remain in place too long Fortunately this practically never occurs because they pass into the intestine in a few weeks unless prevented from doing so by fixation with silk suture brought to the exterior

Biliary Atresia Review of Seven Cases is presented by G C Freeman and H M Sexton[7] The exact etiology of biliary atresia is unknown. The extent of atresia varies from fibrosis of the entire extrahepatic biliary tract to obliteration of a short segment of any one of the ducts In complete atresia the remnants can usually be identified as cordlike veins. Dilatation of the duct proximal to the obliterated area characterizes the atresias involving only a short segment of the duct such cases occur in about 20 per cent of patients and are the ones most amenable to surgery Physical findings are those of obstructive jaundice

Prognosis for cases amenable to surgery is excellent in

(7) Proc. Staff Meet. Clin. Honolulu 15 71 76 September 1949

contrast to the invariably fatal outcome if atresia is allowed to persist In the authors series operation failed to reveal patent bile ducts in six, and a successful anastomosis was made between the duodenum and common duct in one patient In the first group two patients died postoperatively but final follow up is not available for the others

METHOD.—Preoperative treatment should include a high protein, low fat diet with increased parenteral vitamin K Existing electrolyte imbalance or secondary anemia should be corrected. The opportune time for exploratory laparotomy is shortly after the first month of life Drop ether anesthesia is preferred. Careful exploration is carried out through a generous paramedian incision or one below and parallel to the right costal margin. Anastomosis of a patent hepatic or common duct to duodenum offers the best chance for an uncomplicated postoperative course Hepatoduodenostomy, cholecystoduodenostomy or choledochoduodenostomy may be performed if necessary If the patient's condition is poor cholecystostomy can be performed with the hope of a second operation later Anastomoses have been attempted with larger bile ducts after removing the left lobe of the liver but have not proved satisfactory All anastomoses should be made over a rubber catheter Meticulous care should be exercised in closing the incision since wound disruption and evisceration are likely to occur in these infants.

Studies of Biliary Strictures and Their Surgical Treatment in 184 Patients For comparison of results of operations done at different times, Waltman Walters and John M. Cameron[8] divided the cases into (1) a 1924-39 series which includes 98 patients (2) a 1940-47 series with 65 patients and (3) a 1948 group of 27 subjects, 6 of whom were also operated on in previous years Data for 1948 were included only for analysis of present operative procedures.

In general use of duct to duct anastomosis has been increasing in the first series it was carried out in about 11 per cent of cases in the second series in about 18 per cent and in 1948 in 40 per cent Use of anastomosis of hepatic duct to duodenum has also shown a progressive increase The explanation is that strictures were more extensive or higher and that in an increasing number of cases sufficient length of hepatic duct for anastomosis has been dissected out, sometimes from the parenchyma of the liver at the hilus. Thus, use of anastomosis of common duct to duodenum has decreased from 34 7 per cent in the first series

(8) Proc. Staff Meet. Mayo Clin. 25 150-156 Mar 29 1950

to 11 6 per cent in the second and 3 7 per cent in 1948 With isolation of an increased number of duct ends, it was possible to anastomose the proximal end of the duct to the distal end or to the duodenum in about 77 per cent of cases of the first series, in 82 per cent of the second and in 93 per cent of the 1948 series.

Cholangitis occurring after repair of a common duct stricture seems to be due to biliary obstruction secondary to reformation of the stricture rather than to reflux of intestinal contents into the biliary tract

The immediate mortality rate has decreased from 10 per cent in 1924-39 to 3 per cent in 1940-47 and 1948 Over all good late results increased from 53 per cent in the first series to 58 per cent in the second The largest increase in good results (from 42 to 64 per cent) occurred in cases in which the hepatic duct was anastomosed to the duodenum When sufficient common duct above the stricture was present to anastomose it accurately to the duodenum, good results were obtained in about 80 per cent of cases in the two series. When the ends of the duct were anastomosed, good results were obtained in an average of 52 per cent of cases Four patients who had had both hepatic ducts anastomosed to the duodenum were well and without biliary obstruction two three eight and eight years after operation

Benign Fibrosis of Sphincter of Oddi. John P Trommald and Dean B Seabrook[9] (Portland, Ore) report eight cases observed since September 1945 one of which is given here

Man, 57, had been in good health until about two months previously when he had two severe attacks of pain in the right upper quadrant, lasting several hours. A third attack occurred one month later accompanied by gradually deepening jaundice. At operation, the gallbladder was contracted and thick walled, its fundus was adherent to the common duct, which was thick walled and moderately dilated Neither contained any stones. A fine probe and stone forceps were passed through the sphincter of Oddi into the duodenum. Cholecystectomy was performed with difficulty and a short-limbed T tube and Penrose drain were brought out through a stab incision. Two weeks after operation three attempts were made to clamp the tube but each was followed by severe epigastric pain and vomiting A cholangiogram showed complete obstruction at the papilla.

At reoperation, when the duodenum was opened, a beadlike sphincter of Oddi, 1 cm. in diameter, was encountered It would

(9) West J Surg 58 89-94 March, 1950

barely admit a fine probe and allowed no bile to escape (Fig 133) The sphincter was nicked and a probe passed into the pancreatic duct. A no 12 catheter, passed from the supraduodenal portion of the common duct, entered the duodenum easily Over this catheter a 1 cm. cut was made across the upper lip of the papilla. The hepatic and common ducts were explored and irrigated No stones were found The sphincter was stretched to 1 cm. with a hemostat. A short limbed T tube was placed in the common duct and brought out with a Penrose drain through a stab incision

Improvement was rapid A cholangiogram taken on the seventeenth postoperative day showed adequate drainage The T tube

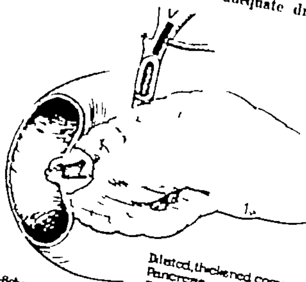


Fig 133 —Schematic drawing of operative findings in benign fibrosis of sphincter of Oddi. (Courtesy of Trommald J P., and Seabrook D B West. J Surg. 58 89 94 March, 1950)

was removed on the twenty-eighth day The patient has been in excellent health ever since

Fibrosis of the sphincter of Oddi appears to be a disease mainly of the sixth and seventh decade The youngest patient was 46 and the oldest 80 (average 60) Even patients who were poor surgical risks because of advanced age and concomitant degenerative disease tolerated operation well. In three cases the severity of the fibrosis had reduced the papillary opening to pinpoint size In two cases the fibrotic sphincter could not be cholangiographically distinguished from stones All the patients were relieved of symptoms after transduodenal sphincterotomy If no malignancy is involved this operation is indicated when a 3 mm dilator cannot be passed into the duodenum

Disease of Sphincter of Oddi Analysis of 70 Observations Collected from Dec 7, 1945 to July 5, 1949 P Mallet Guy, J Feroldi and F Micek[1] (Bratislava, Czechoslovakia) state that as in obstruction of any other hollow viscus, narrowing of the sphincter of Oddi produces progressive dilatation and loss of tonus of the proximal duct system, first noted in the gallbladder and hepatic ducts. The lower segment of the common duct is the last to show this effect. Cholecystography is of no value in showing this change but at operation transvesical cholangiography with radiopaque medium and manometric readings of common duct pressures may demonstrate it and are of value in differentiating early spastic obstruction of the sphincter of Oddi from advanced fibrotic stricture

Therapeutically, the authors emphasize the value of the procaine infiltration test of the vaguses, the response of which can be obtained from the manometric curves and which determines whether bilateral vagotomy is indicated. In 4 of 18 cases, the infiltration test revealed the irreversibility of the functional disturbance which consequently had reached the stage of fibrosis and could only be treated by sphincter surgery When vagotomy is indicated the choice of operation lies among various technics and is influenced by the eventual association of other pathologic disorders (duodenal ulcer) These technics include supradiaphragmatic bilateral vagotomy by the transpleural route, subdiaphragmatic bilateral vagotomy section of the vagal branches at the central portion of the lesser curvature, and gastrectomy, which is also a vagotomy

The only regular indication for choledochoduodenostomy is the coexistence of lithiasis of the common duct. With sclerotic lesion of the sphincter transduodenal sphincterotomy is preferred to choledochoduodenostomy In 25 patients operated on over one year ago, results were excellent in 13 (52 per cent) good in 6 (24 per cent) fair in 4 (16 per cent) and poor in 2 (8 per cent)

Technic of Operative Cholangiography is described by N Frederick Hicken V L. Stevenson, Bruce J Franz and Earl Crowder[2] (Salt Lake City) Since 1934 they have used

(1) Lyon chir 45 161 199 Feb. Mar., 1950
(2) Am. J Surg. 78 347-355 September 1949

visualizing cholangiograms at all operations on the extrahepatic biliary system In over 1,700 studies exact information was obtained that allowed selection of the most suitable operative procedures Diodrast* proved to be an excellent cholangiographic agent For the gallbladder or dilated bile ducts, the authors prefer the 35 per cent concentration, but when the ducts are of normal size, 70 per cent concentration gives better roentgen patterns

TECHNIC—Any operating table can be adapted for cholangiography by placing a wooden tunnel containing a 10 × 12 in. film directly beneath the patient so as to include the upper right and medial portions of the abdominal cavity After the skin incision is made, protective towels and drapes are anchored to the wound margins by sutures. When palpation is completed, diodrast* is injected into the gallbladder or bile ducts, all packs and instruments are removed from the wound and the operative area is covered with a sheet. The x ray unit is quickly placed in position with a tube-film distance of about 25 in. When the technician is ready to take the picture, the anesthetist hyperventilates the lungs and maintains a period of apnea at the height of the inspiratory phase The exposed film is developed immediately making the desired information available within five minutes.

The authors use scout cholangiograms when uncertain of the diagnosis or if they wish to know the extent of the pathologic process When obstructive jaundice is present it is useful to know whether the gallbladder should be preserved for short circuit operations such information is readily obtained from the films No extirpative surgery is attempted until satisfactory cholangiograms are obtained

The functional condition of the larger bile ducts can be accurately determined by the choledochogram Two silk sutures are first placed in the anterior wall of the common duct to pull it away from the posterior wall and thus simplify injection of contrast solution into the duct lumen (Fig 134) If the film shows normal bile ducts further surgical exploration can be avoided should it reveal stones they can be removed (Fig 135) Operative choledochograms are particularly useful when patients who have had a cholecystectomy still complain of symptoms suggesting ductal obstruction Accurate cholangiograms can be obtained by injecting diodrast* directly into the stump of the severed cystic duct if this duct has been obliterated by progressive fibrosis, the medium is injected directly into the lumen of

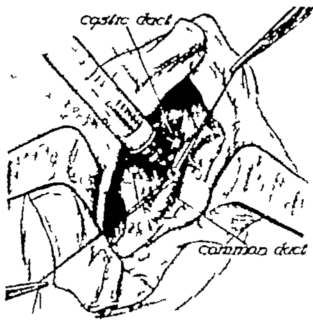




Fig. 134 (top).—Method of exploring common bile duct radiographically after gallbladder has been removed. Two traction sutures placed in anterior wall of common bile duct are used to pull anterior wall away from posterior wall. When exploring needle is in ductal lumen, as shown by aspiration of bile 10-15 cc. diodrast® is injected through needle.

Fig. 135 (bottom).—Small calculus lodged in ampulla of Vater vividly outlined. Dilated common duct signifies long-standing obstruction. Stone does not completely occlude ampullary orifice because diodrast® flows into duodenum. Stone could not be located by palpation even after recognition in choledochogram.

(Courtesy of Hicken, N. F., *et al.*: Am. J. Surg. 78:347-355, September 1949.)

the choledochus or the common hepatic bile ducts If difficulty is experienced in locating the common duct, it is simple to open the duodenum and cannulate the papilla of Vater retrograde choledochograms are particularly useful in locating the distal end of a collapsed common duct which has been severed or accidentally ligated Completion cholangiograms reveal whether all calculi have been removed and whether the ampullary orifice is patent so that bile can flow into the duodenum They also determine the efficiency of the decompressive operation and the exact position of drainage tubes.

Cholangiography actually decreases the operative time by eliminating unnecessary ductal explorations and palpatory examinations Injection of contrast solution and exposure of the film require less than three minutes. While the film is being developed the surgeon can ligate bleeders and proceed with his operation hence there is no delay

Functional Disturbances of Common Bile Duct Recognition with Operative Cholangiography Pablo L. Mirizzi[3] (Cordoba) states that 20 years' experience based on 2,500 operations on the biliary passages mostly for calculi and under control of operative cholangiography has demonstrated the important part played by functional disturbances of the common bile duct on the course of the disease itself and after inadequate surgical treatment. He observed that disturbances of the common bile duct are concomitant with cholecystitis In general disturbances of the sphincter of Oddi dominate the picture however the hepatic duct is occasionally the seat of dynamic disturbances always in association with an anatomic factor or infection. Disturbances of the sphincter of Oddi cause functional disturbances of the pancreas, which produce pancreatic diseases Cholecystitis without concrement produces three times more functional disturbances than calculous cholecystitis The dynamic disturbances of the sphincter of Oddi constitute a gamut of spastic phenomena associated sometimes with reversible or stable anatomic factors These factors must be recognized in order to institute the appropriate therapy and thus prevent sequelae after cholecystectomy Operative

(3) Bol. y trab. Acad. argent. de cir 33 590-611 September 1949

cholangiography with intraduodenal instillation of magnesium sulfate will identify the disturbances

In the beginning, Mirizzi instilled 30 cc of a sterile lukewarm 30 per cent solution of magnesium sulfate through a previously introduced duodenal sound, the metallic extremity of which reached the vicinity of the papilla of Vater Now he injects the solution by direct puncture of the duodenum at the level of its upper flexure

Operative cholangiography, performed with 4 cc lipiodol® injected through the cystic duct at the rate of 1 cc/minute, gives in the successive films unequivocal images of the dynamic disturbance of the sphincter of Oddi whether it is odditis (total spasm of the sphincter) or dystonia (partial spasm), whose roentgen sign is reflux toward the duct of Wirsung, it is regularly recognized without great difficulty To treat biliary stasis correctly it is necessary to determine during the operation the character of the spasm i e., whether it is temporary or permanent If it is temporary, closure without drainage (ideal cholecystectomy) is indicated, or at most transcystic temporary drainage If it is permanent, cysticoduodenostomy must be performed When spasm coexists with an anatomic factor and the opaque medium is retained but the magnesium sulfate has no effect on the sphincter of Oddi or on the stasis of the common bile duct external choledochoduodenostomy is indicated.

It is not easy to differentiate an unciform odditis from a small calculus incarcerated in the papilla of Vater Diagnosis can be established only by taking successive films.

On Reoperation for Choledocholithiasis Experience from and Comments on 34 Operated Cases Erik Millbourn[4] (Univ of Lund) found stones in the common bile duct of 22 of the patients findings were negative in 12 Stones were unquestionably overlooked in the primary operation in 11 cases, probably overlooked in 4 probably freshly formed in 5 and unquestionably freshly formed in 2. Calculi were probably responsible for postoperative symptoms in 6 of the remaining 12 cases they were probably passed spontaneously to the duodenum immediately before reopera

(4) Acta ch Scandina 89 285-312 1950

tion in 4 and after reoperation in 2 Postoperative symptoms were due to cholangitis in one, biliary stricture in one, dyskinesia in two and disease resembling cholelithiasis in two Nonabsorbable suture material should not be used adjacent to bile ducts for it may migrate into them and be the nidus for subsequent calculus formation

Reoperation for postoperative biliary distress must be postponed until jaundice, attacks of cholangitis or increased diastase content of blood or urine are so pronounced as to obviate any doubt as to presence of calculi Diagnosis may be difficult because of the long latent period which may follow the initial operation and the occurrence of signs and symptoms atypical of biliary colic

To avoid overlooking calculi in the deep bile ducts cholangiographic examination should be performed during operation and if choledochotomy is established, it should be performed postoperatively also Cholangiography is especially important if reoperation is contemplated If stones are few small and movable reoperation should be postponed until several months or years after the primary procedure If cholangiography at reoperation discloses that calculi have not been overlooked the prospects of the patient's becoming symptom free are good

The primary mortality in this series was 9 per cent

Adenomatous Polyp of Common Bile Duct Benign Tumors of Biliary Passages Alberto Althabe Dante A. Poggi and Ernesto H. Flachsland Siburu[5] report that at operation on a woman 56 for complete obstruction of the common bile duct by probable tumor of the biliary passages, they found a conical calculus completely obstructing the duct and a polyp 3 cm long and 0.5 cm thick, on the mucosa of the posterior wall. The polyp surface was smooth and pink The base was ligated and the tumor removed. Final diagnosis was adenomatous polyp of the common duct, with slightly inflamed and edematous stroma and without signs of malignancy

According to the literature benign tumors of the biliary passages are rare Clinically their development is masked by misleading common duct obstruction because of their

(5) Bol. y trab., Acad. argent. de cir. 33 350 354 July 13 1949

elasticity and softness they are not felt on digital palpation and instruments are passed for exploration of the permeability of the duct The tumors are frequently associated with stones so are easily overlooked Infection which often accompanies them makes diagnosis even more difficult and hastens their progress In some reported cases the tumors were found at autopsy, other tumors were discovered by the pathologist after the surgeon had failed to find them during repeated operations Tumors that were locally destroyed or removed were definitely cured. Operation should not be delayed, and after removal of the calculi, the biliary passages should be carefully explored manually and instrumentally, if exploration is negative, operative cholangiography is indicated

In discussion, Juan R Michans described a case of lithiasis of the common bile duct in which he found a calculus the size of a hazelnut and a polyp the size of a kernel of corn implanted on the posterior wall of the duct. The polyp was extirpated by torsion of its pedicle.

Carcinoma of Extrahepatic Bile Ducts was found by Harold A. Neibling Malcolm B Dockerty and John M. Waugh[6] in about 0 5 per cent of all cases in which operation was performed on the biliary tract at Mayo Clinic in 10 years In 90 cases it was 1 14 times more frequent in males than in females. Patients average age was 55-60

The etiology of the disease is obscure In a person hereditarily susceptible to carcinoma in this region, long-continued irritation or inflammatory disease may play an important part. Gallstones occurred in 57 per cent of the present series, an incidence much higher than that for the clinic population as a whole or for any comparable group and which seems to corroborate the supposition that cholelithiasis is a contributory factor Furthermore, the close relation of the constituents of bile to carcinogenic agents and the ulcerative or inflammatory lesions and their relation to carcinoma of the bile ducts have been mentioned by various authors.

Eighty-seven per cent of patients presented jaundice, the commonest complaint before operation. Pain occurred in

(6) Surg., Gynec. & Obst. 89 429-438 October 1949

61 per cent at some time in the course of the disease Weight loss was the earliest sign of something amiss Fever and chills were rare

The concentration of direct reacting serum bilirubin averaged about 25 mg /100 cc Acholic stools were noted in 91 per cent of the patients with jaundice Aspiration of duodenal contents showed decrease or absence of bile in the presence of jaundice

Twenty six per cent of tumors were in the hepatic ducts, 35 per cent at the juncture of the common, cystic and hepatic ducts, 32 per cent in the common duct and 3 per cent in the cystic duct. Four per cent of the tumors were diffuse and no definite point of origin along the duct could be determined Nerves were involved in 63 per cent of the cases in which nerves were found in the sections. Pain occurrd more frequently in cases with nerve involvement than in others Jaundice may be due to physiologic as well as anatomic obstruction of the duct thus physiologic obstruction may be due to inhibition of nerve impulses.

All tumors were adenocarcinomas, many of which produced abundant amounts of mucus, only 5 per cent assumed a papillary form

All types of operation from simple biopsy to the Whipple procedure were attempted resection of the involved portion of the duct gave the best results The series seemed to confirm the impression gained in other series that a Roux type of anastomosis is unnecessary and inadvisable Palliative internal or external drainage operations were not successful

The disease was rapidly fatal and was usually far advanced when operation was done Metastasis or extension occurred early in the disease Even in a small group operated on before development of jaundice, metastasis was evident in 75 per cent. Average survival after operation was only three or four months, and after onset of jaundice about five months

Dyskinesia of Biliary Tract Treated by Bilateral Thoracic Sympathectomy C Fr Bisgaard Frantzen[7] (Copenhagen) used this method to treat 16 patients with persistence of

(7) Acta psychiat. et neurol. 4 297 304 1949

symptoms after cholecystectomy The supradiaphragmatic approach was utilized as recommended by Peet for hypertension

Follow up showed that 11 patients had complete or almost complete relief from symptoms One patient had biliary colic, two were symptom free for a year but then had recurrence of pain, and one had pain in the operative scars. In the patients in whom pain developed after one year nerve fibers may have regenerated. In four patients attacks of nausea replaced the attacks of pain. This occurrence corresponds with experimental results which indicate that the sensation of nausea is conducted by the vagus nerve Since the white rami to the three upper lumbar ganglions usually transmit afferent impulses from the biliary tract, complete sensory denervation is not obtained with Peet's operation.

The fact that an attack of dyskinesia of the biliary tract can be relieved by use of amyl nitrite and nitroglycerin proves that spasm in the sphincter of Oddi is important for its origin. Westphal found that in guinea pigs moderate electric stimulation of the vagus nerve below the diaphragm contracted the gallbladder and produced peristaltic movements in the antral portion of the sphincter of Oddi and relaxation of the papilla of Vater A slightly stronger current increased gallbladder contraction and peristaltic movements A stronger current caused violent gallbladder contraction and a spasm of the antral sphincter

This reaction is thought to be the mechanism in biliary tract dyskinesia The question is raised, however whether the condition described is not produced by an unphysiologic stimulus. Westphal also found that stimulation of the splanchnic nerve caused relaxation of the gallbladder and antral portion of the sphincter and contraction of the sphincter of the papilla. Transection of the splanchnic nerve may produce relaxation of the sphincter of the papilla and contraction of the gallbladder and antral portion of the sphincter by relative overactivity of the vagus nerve

Leriche observed that local anesthesia of the right splanchnic nerve in man was followed by contraction of the gallbladder and relaxation of the sphincter of Oddi.

It may be presumed that biliary tract dyskinesia is caused

by a functional disturbance in the neural regulation of the biliary tract probably by overactivity of the sympathetic nerves or of the vagus nerves Westphal called the two mechanisms respectively the atonic form of dyskinesia and the hyperkinetic form

The diagnosis of dyskinesia is usually not established until cholecystectomy has been carried out without relief and no anatomicopathologic condition has been found in the biliary tract to account for persistence of symptoms The author believes that dyskinesia most likely is not produced by the operation but has existed before it In support of this theory is the fact that the greatest relief from symptoms is obtained by cholecystectomy when cholecystitis or gall stones are found at operation In cases in which a normal gallbladder is found at operation the patients symptoms are probably due to dyskinesia and not to obstruction in the biliary tract

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PANCREAS

Surgical Physiology of Pancreatitis John M Howard[8] (Univ of Pennsylvania) states that no etiologic agent common to every patient with acute pancreatitis has as yet been demonstrated, but that an infectious origin seems unlikely Various etiologic factors have been suggested but all are open to criticism.

Basically the response of the pancreas to injury is similar to that of other abdominal organs. The irritation produces a reactive inflammation the resulting edema, vascular engorgement and exudate cause swelling of the pancreas most commonly in the head This may lead to obstruction of the ducts pressure and secondary ischemia which promotes necrosis with additional edema, exudate, pressure and ischemia Finally there may be necrosis of the vascular walls with frank hemorrhage Advanced inflammation and necrosis may be associated with retroperitoneal spread of edema and necrosis along the aorta and iliac vessels to the pelvis. Owing possibly to distention of the pancreatic ducts with

(8) S Clin North America 29 1789 1800 December 1949

resultant rupture of the ductules or acini, or because of increased permeability of the acinar cells from ischemia pancreatic enzymes are *released into the peripancreatic* tissues and the peritoneal cavity Thus, there may be an enzymatic peritonitis Since most of the necrotic fat and the greater concentration of lipase are near the pancreas and adjacent viscera most of the fat necrosis would be expected to occur in these areas, however, it is occasionally found scattered throughout the peritoneal or retroperitoneal tissues These calcified plaques may be found during the first 24 hours of illness, after 2 weeks they may be encapsulated with fibrous tissue and grossly unrecognizable Their ultimate fate has not been demonstrated. Amylase is also released locally and possibly reacts locally to speed the hydrolysis of glycogen in the tissues. The peritoneal exudate also contains activated trypsin, which, however does not prevent formation of a fibrin clot in the exudate

In pancreatic trauma, amylase is absorbed directly into the blood stream and may increase to diagnostic levels in a few hours, i.e., any concentration over 300 Somogyi units/100 cc serum As the concentration of amylase increases in the serum, the amount excreted in the urine increases. The increased concentration and excretion persist so long as there is progressive pancreatic damage, usually falling to a normal level after 48-96 hours. Serum lipase is also increased and the rise may be prolonged *for* several days after the amylase concentration has returned to normal. The concentration of trypsin in the serum cannot be accurately measured but is probably also elevated Many of the patients are jaundiced tests frequently reveal hepatic damage but its cause is unclear There is often a coincident abnormality of gallbladder function. The effect on the rest of the gastrointestinal tract seems nonspecific Intubation of the duodenum during the first few days of illness may show a temporary absence of pancreatic enzymes, probably *due to obstruction of the pancreatic ducts* Cardiovascular hematologic effects are hemoconcentration and decreased blood volume, varying degrees of peripheral vascular shock, leukocytosis hypocalcemia and hyperglycemia There is a high incidence of pulmonary atelectasis secondary to para

lytic ileus and abdominal distention Wound healing is frequently slow, and wound disruption is higher than in most abdominal diseases The cause of death from pancreatitis is toxemia, and the cause of toxemia seems to be infection Traumatic pancreatitis almost always results from a direct injury infrequently from a blow on the anterior abdominal wall. Necrotic tissue is always minimal and the manifestations are usually those of a slowly developing retroperitoneal collection

The pancreas heals by fibrosis and probably regeneration. In mild edematous pancreatitis, histologic recovery is almost complete in 10-14 days in more severe cases with patchy necrosis and hemorrhage it may take 1 month, but residual fibrosis and distortion of the acini remain Functional recovery usually takes place within the first week unless necrosis is progressive Massive necrosis and hemorrhage may heal by fibrous encapsulation giving rise to pseudocyst which may still contain blood several months later

The measurement of serum amylase concentration as a quick diagnostic test of acute pancreatitis permits the clinician to outline a definitive course of treatment Application of the physiologic principles to treatment has centered around decompression of the biliary tract and prevention of reflux of bile into the pancreatic ducts prevention of pancreatic ischemia treatment of associated peritonitis and its sequels and drainage of pancreatic collections

Contribution to Pathogenesis of Acute Pancreatitis O F Longo C Sosa Gallardo and A. Ferraris[9] (Córdoba) report that by subjecting dogs to anaphylactic shock, all the histopathologic lesions of acute pancreatitis were reproduced These lesions are characterized by striking vasodilatation, edema, hemorrhage and sometimes cellular necrosis Electric excitation of the left splanchnic nerve produces the same results. When the left sympathetic chain is resected and more than seven days allowed to elapse, electric stimulation of the peripheral extremity of the left splanchnic nerve does not cause any remarkable changes but if the

(9) Lyon chir 45 p 306 April, 1950

stimulation is performed before seven days have passed, the phenomenon is observed to its full extent.

Because of their etiopathogenic microscopic, clinical and therapeutic similarities the authors believe that functional infarct of the intestine and acute pancreatitis have a common etiologic origin.

Experimentation and study of human pathology have demonstrated the value of intravenous procaine in acute pancreatitis Since 1947 the authors have given 1 per cent procaine solution intravenously with satisfactory results in 10 of 12 patients. The drug does not cure the disease but has a number of advantages.

1. Pain is eliminated a few minutes after injection of 20 cc of the solution, or preferably of 0.5 Gm procaine in 500 cc. saline solution administered drop by drop twice daily The action is similar to that of paravertebral anesthesia without the disadvantage of a possible fall in blood pressure which may aggravate the shock. Procaine anesthetizes *the nerve endings of the involved zone and then* the sensitive sympathetic fibers splanchnic anesthesia, to block the nerve trunks, suppresses the innervation of the pancreas simultaneously preventing secretion of epinephrine which supports vasomotor tonus.

2 Intravenous procaine avoids the generalized vascular collapse which is sometimes a symptom of the disease The injection decreases pancreatic secretion or reduces vagal hyperactivity because it corrects the lack of equilibrium of any vegetative nervous system by sympathetic or vagal predominance

3 Regardless of what physiopathologic concept is accepted to explain the mechanism of onset of acute pancreatitis, intravenous procaine given drop by drop acts efficaciously against the releasing element and does not present the disadvantages observed with use of some other drugs.

Acute Pancreatitis Clinical Evaluation and Review of 154 Cases is presented by Louis J Morse and Samuel Achs[1] (Brooklyn) Seventy-six per cent of the patients were female an incidence similar to that in concurrently observed

(1) Ann Surg. 130 1044 1058 December 1949

cases of gallbladder disease Half the cases occurred in the fourth and fifth decades All but 19 patients had histories of some form of dyspepsia, and 63 per cent had histories of biliary disease

If a patient with a history of gallbladder disease presents a somewhat altered symptom complex, if morphine fails to alleviate pain radiating from the epigastrium transversely to the left if cyanosis and slight icterus with a peculiar asthenia and dyspnea occur acute pancreatitis must be considered. Tenderness over the left hypochondrium and left costal vertebral area strengthens the clinical diagnosis. Differential diagnosis may include acute empyematous cholecystitis perforated gallbladder, acute high intestinal obstruction, left renal colic, left renal abscess perforated peptic ulcer coronary and cardiac disease or acute appendicitis

Useful laboratory aids include the serum amylase test in which elevation may be detected if it is performed early in the illness Serum lipase determination is of greatest value after the first 48 hours, its concentration remains elevated for a longer time than that of amylase Formation of calcium soap in areas of fat necrosis results in an absolute hypocalcemia, which is most apparent between the fourth and tenth day Serum calcium levels below 7 mg/100 cc have a fatal prognostic significance If the patient's condition permits, a barium meal may disclose a wide duodenal sweep irregular greater curvature of the stomach, pyloric obstruction or a depressed transverse colon. These are all signs of an enlarged pancreas

In treatment of acute pancreatitis, immediate operation is justified only when diagnosis is uncertain, when peritonitis is pronounced, when ileus persists without improvement or when abscess is present Subsequent surgery may be contemplated after an acute phase especially when cholecystitis is the precursor Therapy should be directed toward stopping the activation of pancreatic trypsin, which is the basic mechanism in the pathogenesis of this disease The medical regimen generally used includes starvation continuous gastric suction relief of pain with opiates and procaine injection of splanchnic nerves restoration of normal blood concentration and volume with whole blood

plasma or glucose, prevention of distention by Miller Abbott intubation, inhibition of nervous stimulation of the pancreas by atropine and ephedrine, and recognition and elimination of hypocalcemia with calcium gluconate Cholecystectomy is the operation of choice, if performed 7 10 days after subsidence of acute symptoms Ligation of the cystic duct is omitted and a soft rubber tube is placed over the cystic duct stump, establishing a vent for biliary drainage should sphincteric spasm with possible recurrent pancreatitis ensue If a drainage tube were placed in the cystic duct and spasm did not occur, convalescence would be unduly delayed by persistent biliary drainage.

Various operative procedures were used in treating the 154 patients in this series Over all mortality was 24 per cent In 30 cases in which cholecystectomy was performed, mortality was 6 6 per cent, in 83 with cholecystostomy, 24 per cent, in 22 with pancreatic drainage, 60 8 per cent.

Acute Pancreatitis with Hyperlipemia Clarence E Gardner Jr., and Blake Fawcett[2] (Duke Univ) report on two cases Acute abdominal pain led to emergency hospitalization. Both patients had milky blood serum from increase in blood fats, and in both hyperglycemia, glycosuria and ketonuria developed The hyperlipemia disappeared as the attack subsided, and carbohydrate metabolism was brought under control with insulin. Constant stomach suction drainage, maintenance of fluid, salt and calcium balance and transfusions aided in complete subsidence of all signs and symptoms except mild diabetes, which persisted in both.

In these patients hyperlipemia was considered the direct result of pancreatic injury on fat and carbohydrate metabolism rather than of diabetes alone Disturbed carbohydrate and fat metabolism if left uncorrected may cause death in patients with pancreatitis. Experience with these patients has suggested that damage to both antidiabetic and antilipemic hormonal factors should be investigated in patients with acute pancreatitis.

Surgical Implications of Acute Pancreatitis Analysis of 85 Cases. J G Probstein, S H. Gray, L A. Sachar and W J Rindskopf[3] report that from 1934 to July 1947 85

(2) Surgery 27:512-519 April, 1950
(3) Arch. Surg. 59 159 198 August, 1949

of 51,500 patients admitted to the surgical and medical services of Jewish Hospital St. Louis, had acute pancreatitis The true incidence was probably even greater because in the first years of this period many cases were undoubtedly overlooked. It is now the routine to order a blood diastase determination in any case of pain in the upper abdominal area Concurrent acute cholecystitis was suggested on clinical grounds in 16 of the 85 episodes of pancreatitis. Actually, 15 episodes occurred after cholecystectomy, hence 16 (23 per cent) of a possible 70 patients presumably had concurrent acute cholecystitis. During the same period, 121 patients with acute cholecystitis, including the 16 already mentioned, were seen, thus, 13 per cent of the patients with acute cholecystitis had concurrent pancreatitis.

This significant correlation has three possible explanations cholecystitis caused pancreatitis, pancreatitis caused cholecystitis or both were caused by a common factor The third explanation seems the most tenable the common factor would be obstruction distal to the junction of the pancreatic and common bile ducts converting them into a common channel.

That there is actually a reflux of pancreatic juice into the gallbladder during an acute attack of pancreatitis was shown in 1933 by Popper, and this observation, which can be explained only by the common channel theory of pancreatitis, was confirmed by the authors in two patients at operation.

In the present series there was no constant distinctive pattern which would allow certain diagnosis without exploration or determination of serum or urine diastase levels Immediate prognosis after an attack of pancreatitis was good. There were three deaths two on the 2d day of the disease and one on the 24th day The disease, however, has a great tendency to recur Fourteen patients were observed during recurrent attacks, verified by the finding of a high blood diastase level. Another 15 gave a history of one or more similar attacks.

The general policy at Jewish Hospital is not to operate during an acute attack. However two patients were operated on in one, acute hemorrhagic pancreatitis was found and he died the day of operation the other recovered The

other patients were treated conservatively and two died. Exploration seems warranted when inflammatory signs and symptoms persist

After the attack has subsided, the question of cholecystectomy often arises, particularly if the Graham test reveals gallstones or a nonfunctioning gallbladder Cholecystectomy was done on 12 patients and explorations of the common duct on 6 of these stones were found in the common duct of 2, and 2 of the patients subsequently had recurrence of pancreatitis Nine other patients had acute pancreatitis after undergoing cholecystectomy

It is clear that cholecystectomy, with or without exploration of the common duct, has not been a certain way of preventing acute pancreatitis When cholecystectomy is performed after an attack of acute pancreatitis, the common duct should be explored However occurrence of acute pancreatitis after cholecystectomy is not an indication in itself for exploration or re-exploration of the common duct. In the authors' experience recurrent pancreatitis has tended to be self limited no case has progressed to chronic pancreatitis

[It is very interesting to see the change in attitude toward acute pancreatitis which has occurred in a comparatively few years. Not so long ago it was regarded as a great surgical emergency demanding an operation as soon as the diagnosis was suspected. Now however the general tendency is to treat it much more conservatively as the articles here indicate. Although it has been repeatedly demonstrated experimentally that reflux of bile into the pancreatic ducts will be followed by necrosis of the pancreas, this mechanism does not seem to explain all cases. Moreover if such a mechanism is assumed to be the etiologic factor in any case, one must still attempt to explain the reasons for the failure of such reflux to occur in infancy or at least long before middle age. In other words, there must be some factor which causes the reflux of bile other than merely an anatomic formation which would permit the bile to enter easily into the pancreatic ducts. If it were due only to the anatomic arrangement of the ducts, one might expect acute pancreatitis to occur frequently in infancy —Ed.]

Treatment of Chronic Pancreatitis by Unilateral Splanchnicectomy Pierre Mallet Guy and Michel Jaubert de Beaujeu[4] (Univ of Lyon) report results in 70 patients treated over 6½ years Operation is carried out in the subperitoneal lumbar region after muscular dissection or resection of the twelfth rib if it was long The great splanchnic nerve is excised for at least 3 cm. and possibly some minor fibers

(4) Arch. Surg 60 233 241 February 1950

are dissected as they pass through the diaphragm and sectioned at the horn of the semilunar ganglion.

There was one postoperative death Observation was less than one year in 32 cases, most of these recent operations were outright successes. In 37 cases observed for over one year there were 5 failures (13 5 per cent), 1 indifferent result (2 7 per cent) and 31 favorable results (83 8 per cent) which were graded excellent in 21 (56 8 per cent), very good in 7 (19 per cent) and good in 3 (8 per cent) The results are the more striking since a certain number of patients had lesions which contraindicated all other methods of treatment or had uselessly undergone a series of operations usually performed for pancreatitis In addition there were often lesions of the gallbladder requiring simultaneous cholecystectomy or temporary cholecystostomy Most of the patients obtaining satisfactory results had chronic pancreatitis combined with hypotonic biliary ducts which constitutes the best indication for splanchnicectomy

The excellence of both immediate and late results contrasts splanchnicectomy with biliary operations in which results are often poor or transitory Its mild character and simplicity often make it replace left sided pancreatic resection, considered as removal of lesions generating reflexes Most important of all it is bilateral in character it leaves room for a limited resection (left sided) which is indicated on failure of neurotomy or as a complement of it. After improvement in biliary flow obtained through drainage or anastomosis in a case of infection or partial compression of the common duct or of slight hypertonia, splanchnicectomy can be justified as a second stage in treatment of persisting pancreatic lesion.

Biliary anastomosis, justified when there is compression or abnormal appearance of the choledochus may assume a new importance as the first stage in treatment. But the limits of its application can be set only by operative exploration of the pancreas and biliary ducts, which makes it possible to determine the nature of the lesions, test the biliary ducts, treat a combined biliary lesion and decide whether splanchnicectomy is indicated.

Bilateral Splanchnicectomy and Lumbodorsal Sympathectomy for Chronic Relapsing Pancreatitis was performed by

John E. Connolly and Victor Richards[5] (Stanford Univ) for relief from pain. This operation does not correct the causes of pancreatitis or hypertension, but the relief it gives from pain may obviate opiate addiction One of two cases follows

Woman, 36, had had recurrent attacks of severe epigastric pain radiating to the back for four years, associated with considerable vomiting and weight loss. Biopsy of the pancreas a year before hospitalization showed fibrosis and chronic inflammation After closure of a pancreatic fistula, the patient was discharged but soon returned because of recurrent pain and weight loss. Pancreatectomy was planned, but in view of the patient's debilitated state splanchnicectomy and dorsal sympathectomy were carried out (after paravertebral procaine block gave transient relief) She obtained relief from the severe abdominal pain and gave up narcotics.

The operation performed in these patients, both of whom obtained relief from pain, was a one stage bilateral modified Peet procedure Portions of the last two ribs were removed on both sides, allowing excision of the sympathetic chain from the seventh or eighth thoracic to the second lumbar ganglions and of the greater lesser and least splanchnic nerves With two operating teams working simultaneously, time for the operation averaged about an hour Although the operation may not be the best physiologic approach to chronic relapsing pancreatitis, the authors believe it to be the best available means of relieving the accompanying pain.

Squamous Cell Carcinoma of Pancreas O C Lowry, H W Whitaker Jr and D J Greiner[6] (Veterans' Admin., Memphis, Tenn) report one case of squamous cell carcinoma of the pancreas and two of adenoacanthoma of the pancreas. In each case there was chronic pancreatitis but it was not dependent on obstruction of the larger ducts by the tumor Association of these lesions with chronic inflammation is in keeping with the changes in the epithelium of the bronchi and gallbladder in which metaplasia occurs with inflammation Two patients had mild diabetes of long duration. In these cases carcinoma was probably related to the accompanying inflammation, which may be seen in the pancreas in diabetes, rather than with the diabetic condi

(5) Ann. Surg. 131:58-63 January 1950
(6) South. M J 42:752-757 September 1949

tion The inflammatory process may have contributed to the metaplasia of the ductile epithelium Considering the relative frequency of squamous metaplasia in the epithelial lining of the pancreatic ducts it is surprising that so few cases of squamous cell carcinoma and of adenoacanthoma of the pancreas have been reported

Pathogenesis of squamous cell carcinoma alone or in combination with adenocarcinoma has not been adequately explained Though definite proof is lacking the histopathologic appearance of these tumors indicates that squamous cell carcinoma originates in an area of squamous metaplasia and that adenoacanthoma represents a metaplasia of cylindric elements A rare possible source of squamous cell carcinoma is cancerous degeneration of the epithelial elements of a dermoid cyst of the pancreas

Total Pancreatectomy for Hyperinsulinism Due to Islet Cell Adenoma Follow Up Report 5½ Years after Operation, Including Metabolic Studies is presented by James T Priestley, Mandred W Comfort and Randall G Sprague[7] (Mayo Clinic)

Woman, 49, was hospitalized in 1942 because in three years she had had several episodes characterized by loss of consciousness for one to five hours. Glucose given intravenously was necessary for relief She had more frequent minor episodes characterized by sensations of dizziness or confusion or by spells of profuse perspiration. The latter spells occurred almost daily between 10 a.m. and noon and were promptly relieved by ingestion of orange juice.

General physical examination gave essentially normal results. All laboratory and roentgen studies revealed normal findings except for those pertaining to blood sugar Fasting concentration of blood sugar was 42 mg./100 cc. After a fast of 18 hours, the patient had a severe hypoglycemic reaction, starting with drowsiness and sweating and proceeding to loss of consciousness. Blood sugar at this time was 29 mg /100 cc. Diagnosis of severe hypoglycemia, probably due to a hyperfunctioning tumor of the islets of Langerhans, was made.

Exploration of the entire abdomen, and pancreas in particular, failed to reveal any abnormality Because of previous unsatisfactory experience with partial resection of the pancreas in these circumstances, total pancreatectomy was performed. Only after prolonged search was a cellular adenoma of the islets of Langerhans found in the head of the pancreas. It measured only 8 × 5 × 5 mm.

The patient returned for re-examination in 1948, having remained in essentially good health in the interim. Her only com

(7) Am. Surg. 130 211 217 August, 1949

plaints were lack of energy and mild, intermittent, cramping abdominal distress, relieved by bowel movements. As a rule she had three or four movements each day, the feces being light in color and somewhat bulky She had a craving for sweets. She had taken no pancreatin because it caused abdominal distress. Weight varied little from that at discharge after surgery Physical examination gave essentially normal results.

The following effects of total loss of internal and external pancreatic secretions were observed in 1942 and again in 1948 After total pancreatectomy in 1942 the diabetic state was quickly established For three years, glycosuria was controlled with a single daily mixed dose of protamine zinc insulin and regular insulin administered before breakfast. Total daily dose averaged about 30 units Because of almost continuous pruritus vulvae and the suspicion that it might be related to protamine, the patient changed to a mixture of regular and crystalline insulin taken as a single dose (28-40 units) before breakfast. No insulin was taken during the rest of the day On this regimen she experienced an insulin reaction almost every afternoon, and almost every night after midnight she had symptoms of uncontrolled diabetes—thirst, polyuria and leg cramps Intense glycosuria was the rule on the first test in the morning A few hours after administration of the morning dose of insulin, symptoms of uncontrolled diabetes subsided. Pruritus vulvae was relieved

The behavior of the diabetes with a single morning injection of quick-acting insulin each day suggests that it was only of moderate severity In severe diabetes, such as commonly occurs in children, adolescents and young adults, such a program of insulin administration is often followed by severe acidosis within 24 hours after the last dose of insulin, as a result of the waning action of insulin.

The patient was studied in the metabolic unit during the early postoperative period Diabetes was well controlled and she was taking a liberal diet of solid food. In contrast to the controlled diabetes, digestion of protein and fat was definitely abnormal. Approximately 35-70 per cent of ingested fat could be accounted for in stools. Administration of pancreatin in gelatin capsules did not significantly affect absorption and digestion of fat. Studies of ingested nitrogen revealed that 25-55 per cent was present in stools Daily

loss of nitrogen varied from 2 92 to 8 28 Gm Nitrogen balance was positive at all times, despite large losses in feces Repetition of these studies in 1948 revealed that the disturbance of digestion and absorption had not altered

Neither total pancreatectomy nor huge losses of fat in feces had appreciably altered concentration of plasma lipids and serum proteins or liver functions. The patient for more than five years had received a mixed diet estimated to contain about 1 800 mg choline daily She had not taken pancreatin lipocaic raw pancreas or supplementary choline or methionine On this program the hypolipemia or disturbed hepatic function found in pancreatectomized dogs had not developed

Results of Pancreatoduodenectomy Although this procedure was developed primarily for excision of carcinoma of the ampulla or papilla of Vater and carcinoma of the head of the pancreas Alexander Brunschwig[8] (Memorial Hosp., New York City) maintains that it is indicated for carcinoma of the duodenum of the terminal portions of the common bile duct and of the lowest segment of the pylorus when the head of the pancreas is invaded Of 23 patients operated on by this procedure, surgical mortality was 50 per cent in the first 10 but only 7 7 per cent in the other 13

Of the 17 patients surviving the operation 9 lived two to nine months and died of disease Good palliative results were achieved in six patients, three of whom are living an average of 4⅓ years postoperatively without evidence of recurrence Two patients with obvious lymph node metastases at operation, have survived 2½ and 6 years. The first had primary carcinoma of the duodenum that had invaded the head of the pancreas and the second had a large neoplasm of the ampulla of Vater

(8) Cancer 2 763 764 September 1949

INTESTINAL OBSTRUCTION

Cause of Death in Strangulation Obstruction Experimental Study—*Clinical Course, Chemical, Bacteriologic and Spectrophotometric Studies*—Paul Nemir, Jr., H. R. Hawthorne, Isidore Cohn, Jr, and David L Drabkin[9] (Univ of Pennsylvania) created strangulated ileac obstruction in dogs, treated them for hemorrhage, shock, dehydration and electrolyte loss and studied blood, peritoneal fluid and gut contents. Of seven animals six died 28.25-48 hours after obstruction and one lived for 75 hours, when the strangulated segment was resected

Two to four hours after obstruction a small amount of reddish black, odorless, coagulable fluid was aspirated from the gut lumen. As damage to the strangulated gut wall increased, the amount of this fluid became greater At about 12 hours the fluid was black and noncoagulable and had a foul odor There were no further changes in its character but volume increased strikingly At two to four hours peritoneal fluid was pink, clear and odorless and was derived almost entirely from the serosal side of the strangulated gut. At variable stages, corresponding closely with abrupt change in the clinical condition of the animal, peritoneal fluid changed from a reddish black to black and was similar in characteristics to the bowel content. Death occurred 1-4 hours after this fluid appeared in the peritoneal cavity, in the animal which lived for 75 hours black fluid never developed in the gut or peritoneal cavity The peritoneal fluid was sterile until about 14-20 hours when flora of the strangulated gut, usually hemolytic clostridia, Bacillus coli and nonhemolytic streptococcus appeared. At death the black peritoneal fluid in three animals contained the same organisms as were found in the gut.

The absorption spectrum of the black peritoneal fluid was strikingly and characteristically different from that of

(9) Ann. Surg. 130:857-880 November 1949

oxyhemoglobin and identical with the spectrum of the contents of the strangulated bowel segment Spectrophotometric analysis and chemical examination of the black fluid from the strangulated bowel and peritoneum indicated presence of a hemin or hemoglobin derivative which has not been described previously

Lethal Action of Peritoneal Fluid—To test toxicity of peritoneal fluid, the authors intraperitoneally or intravenously injected dogs with different types The pink, odorless, coagulable peritoneal fluid did not cause death in any of six animals even when 425 cc was injected intravenously When the reddish black or black fluid was injected, two dogs died 6 and 7 hours after intraperitoneal administration and two at 5 and 30-40 hours after intravenous injection Considerably less black fluid was given than pink fluid. Spectrophotometric analysis suggested a direct relation between the degree of toxicity of the fluid and its content of the unknown pigment However, at present there is no evidence identifying the pigment itself as the toxic agent

Observations in Strangulation Obstruction Fate of Sterile Devascularized Intestine in Peritoneal Cavity Harold Laufman, Wayne B Martin, Harold Method, Stanley W Tuell and Harry Harding[1] (Northwestern Univ) devised a means of demonstrating the effects of autolysis of devascularized intestine in the host's peritoneal cavity in relative absence of pathogenic bacteria (1) In 21 dogs a 15-20 cm loop of lower ileum was isolated from its continuity and an anastomosis created around it. It was washed out with sterile isotonic salt solution and cut open in its entire length on the antimesenteric border, and the abdomen was closed Fourteen animals survived without apparent ill effects. (2) Six to eight weeks later the segment was cut free from its mesenteric blood supply and from the many adhesions, the omentum was amputated to prevent formation of a new blood supply to the segment which was reimplanted in an adhesion free portion of the peritoneal cavity, usually the right upper posterior portion, and the abdomen was closed. Cultures from tissue taken at this time from 11 animals showed in 8, bacterial forms of the kind usually *found*

(1) Arch. Surg 59 550-564 September 1949

in the intestines All but two were given penicillin for three days to counteract any pathogenic bacteria which might have been present or introduced by the surgery, in the two exceptions, cultures revealed no bacterial growth. The animals were then watched for periods up to three months Many gained weight and all appeared healthy

(3) Three to 14 weeks later, the previously implanted segment was examined. Cultures of tissue from eight animals revealed no growth in four, Escherichia coli in two and Staphylococcus albus and Aerobacter aerogenes in one each. At three weeks the tissue presented a gelatinous appearance At six to eight weeks it bore no gross resemblance to intestinal tissue in some animals there remained only a thin white strand, resembling a cooked noodle and in others, a small plaque, no larger than a pea, partially adherent to a loop of small intestine or parietal peritoneum. At 10-14 weeks only tiny bits of tissue remained. In one animal exhaustive search revealed no trace of the tissue except for an almost insignificant adhesion at the site where it was thought the tissue had been implanted

The demonstration that a strip of devascularized ileum will undergo almost complete autolysis in the peritoneal cavity without ill effects if the tissue is relatively bacteria free may have important implications in the search of toxic factors in intestinal strangulation and allied conditions.

Physiopathology of Experimental Intestinal Obstruction Mechanism of Death, Humoral and Histologic Changes Hene Mansur Sadek, José Gonzaga Ferreira de Carvalho and Aderbal Cardoso Cunha[2] divided the 18 male dogs studied into four groups 5 with high subvaterian occlusion, 2 with high supravaterian occlusion, 8 with low ileal occlusion and 3 with simultaneous high and low occlusion (for the study of blood plasma volume)

The physiopathology of high obstruction differs from that of low obstruction. This does not mean that the two mechanisms are completely separated for the two cross one another and are bound together However, there is predominance of certain factors over others and each one is important.

(2) Arq. de cir clin. e exper 12 355-368 July Aug., 1949

Death in low obstruction is not due to organic intoxication alone but depends also on shock Distention plays a primary role and brings about loss of plasma volume it causes stagnation in the venous capillaries anoxia and consequent local hyperplasmosis These phenomena increase gradually with progress of the obstructive process and increase distention There is loss of circulating plasma volume and consequent relative increase in vascular capacity hence there is a generalized collapse which causes a syndrome similar to shock, culminating in death

In supravaterian obstruction vomiting dominates the picture resulting in fluid loss and dehydration. Since there is greater elimination of acid radicals the alkali reserve rises and alkalosis results In subvaterian obstruction vomiting causes dehydration not only by fluid loss but also by greater elimination of basic radicals coming from the alkaline duodenal contents This results in acidosis The consequence is loss of volume and anoxemia of the tissues, bringing about the following tissue alterations petechial hemorrhages in the liver kidneys spleen, thyroid, lungs and mesentery transudation in the peritoneal cavity and pulmonary edema The congestion, hemorrhages and edema of the lungs aggravate the anoxemia, resulting in loss of tonus of capillaries and venules and finally circulatory failure, probably by increasing the volume capacity of the vascular system This results in shock High intestinal occlusion in most cases ends in death through shock. But this mechanism is not exclusive, since death may also result from organic intoxication.

The authors conclude that in high occlusion death is due predominantly to dehydration through the syndrome of shock, that organic intoxication is a factor of relatively lesser importance, and that the reverse occurs in low occlusion.

Intestinal Obstruction. Walter F Becker, Charles E Davis, Jr., and Edwin P Lehman[3] (Univ of Virginia) reviewed 406 cases of mechanical intestinal obstruction from which were excluded all cases due to malfunctioning colostomy, rectal stricture congenital atresia, congenital megacolon

(3) Ann. Surg. 131 385-391 March, 1950

impaction of feces or bowel tumors without clinical symptoms of obstruction The youngest patient was 1 day old and the oldest 86 years 62.3 per cent were males Obstructions in the small bowel occurred in 89 9 per cent and primary large bowel obstruction in 10 1 per cent. Obstruction was complete in 33 7 per cent and partial in 66.3 per cent. Operation or autopsy revealed strangulation obstruction in 43 3 per cent, a somewhat higher incidence than usually recorded, because any circulatory compromise was regarded as evidence of the condition. Bowel resection was performed in 12 per cent.

Symptoms of obstruction *lasted less than 24 hours in* 38 6 per cent. Adhesions and external hernia caused obstructions in 76 1 per cent and neoplasms in 8 6 per cent. Intussusception was the cause in 27 patients, of whom 16 were below age 10, and accounted for one third of all obstructions in this age group

In the entire series there were 83 deaths, a mortality of 20 4 per cent, but nine patients were moribund when admitted In small bowel obstruction, mortality was 20 3 per cent and in large bowel obstruction 21 9 per cent. Death occurred in only 10.2 per cent of cases of partial obstruction and in 25 6 per cent of those of complete obstruction. Mortality was almost three times as great in patients with obstruction for more than 24 hours Mortality in inguinal hernia obstruction was 10 8 per cent.

In patients with reversible obstruction such as that due to recent infectious peritonitis or to recent surgical invasion of the peritoneum treatment was by tube decompression. Patients with irreversible obstructions such as those due to old adhesions were prepared with intravenous fluids or whole blood passage of Levin or Miller Abbott tube and antibiotics, but all were subjected as soon as possible to operation for relief from obstruction, promptness being essential for success.

Surgical Aspiration of Bowel in Advanced Obstruction. Carrington Williams and Carrington Williams, Jr [4] (Med College of Virginia) report remarkable recovery of 12 of 14 desperately ill patients treated by this method. All had

(4) Ann. Surg 131 846-853 June, 1950

advanced obstruction with great distention of the small bowel and the usual grave blood chemical changes and poor condition of the bowel wall Obstruction was due to incarceration or strangulation of hernia adhesive bands volvulus, paralytic ileus intussusception or carcinoma In four, bowel resection was necessary Two patients died one whose distention could not be relieved by suction and another with perforation and generalized peritonitis

METHOD—A distended loop of bowel is emptied by gentle manipulation and compressed by fingers. A purse-string suture is placed, an opening made into the lumen through it an ordinary suction tip inserted and the suture tied around the tip Low pressure suction is started, and as the bowel collapses it is threaded on the 6-8 in suction tip By gentle manipulation about 6 or 8 ft of bowel can be emptied, distended coils straightened and fluid and gas contents guided toward suction When aspiration is completed, enterostomy is established through the same opening Appropriate steps may then be taken to relieve the obstructing lesion. Adequate restoration of fluid and electrolyte balance must be sacrificed to the operation which will remove the cause of the disability Postoperatively it is important to keep the bowel empty This may be accomplished by stomach suction, enterostomy tube or in some cases, strong purgation The proper intravenous fluids, electrolytes, blood and antibiotics must be continued postoperatively

Intussusception in Infants and Children. William H Snyder Jr Alfred R Kraus and Lawrence Chaffin[5] analyzed results obtained in 143 consecutive cases at Children's Hospital Los Angeles during the last 10 years

Average duration of symptoms before surgery was 28 hours Onset of symptoms was usually abrupt the attacks of pain were often followed by nausea and vomiting and, in 55 per cent of the cases by bloody stools an abdominal mass was palpated in 69 per cent X rays of the abdomen or barium enema x rays were taken in 22 per cent They are occasionally helpful when diagnosis is in doubt, and barium enemas are at times even curative However, it must be remembered that intussusception may involve only the small intestine and that a barium enema in this type cannot be helpful and may be misleading

Clinically the authors recognize two types of intussusception type 1 in which the intussusceptum is tightly held by the intussuscipiens causing interference with blood sup-

(5) Ann. Surg. 130: 60 10 August, 1949

ply and complete obstruction, and type 2, in which the intussusceptum is loosely held and therefore at first causes only partial obstruction and little vascular damage These types can be definitely determined only at operation. This concept explains why in some cases (3 in this series) a gangrenous loop develops only 24 hours after onset of symptoms and in many cases (12) it may be as long as 3 days or more before there is real damage to the intussuscepted intestine it further explains why in some cases symptoms are milder and evidence of complete obstruction and toxicity are not present even after the first day or two of the disease

Surgery is indicated when it is reasonably certain that intussusception exists. If use of conservative means of reduction is confined to diagnostic procedures, such as barium enemas, when the signs and symptoms are not clearcut, there will be no undue procrastination and the general mortality can be reduced Mortality can be further reduced by institution of measures directed toward correcting the alterations of body economy produced by the intussusception. Intranasal gastric suction is indicated in all cases. Half of the patients in the authors series were in good general condition, and no preoperative therapy seemed indicated. In those in poor condition the few hours taken in administering fluid, electrolytes blood and antibiotics are well spent. In only 4 per cent was resection necessary In such cases or when the intussusceptum is badly damaged, the authors introduce 1 Gm. streptomycin through a small gauge needle into the intestine proximal to the anastomosis or to the intussusception, and in addition, use full parenteral administration of antibiotics. Appendectomy was also performed in 24 cases and a Meckel diverticulum was removed in 4 in which there was little damage to the intussusceptum and the child was in good condition. Patients with resection or severe damage to the intussusceptum were given strenuous postoperative care

Of the 143 patients, 7 (4.8 per cent) died 125 were operated on and 18 were treated conservatively In the operative group there were five deaths (4 per cent) Diagnosis was missed in two patients brought to the hospital almost moribund and death occurred

The authors believe that these good results were due to early diagnosis by an alert pediatric staff, general agreement that surgery is indicated as soon as diagnosis is made and the patient prepared, and proper preparation and after-care

Intestinal Obstruction in Newborn The chance of survival of the newborn with intestinal obstruction has been increased by improved diagnostic, supportive and operative technic, but not to the extent achieved in adults. Donald M. Glover and Frank McA Barry[4] (Cleveland) reviewed 26 cases of intrinsic and 21 of extrinsic obstruction which were cared for by a number of surgeons in three large general hospitals The most pertinent causes of death are premature birth of infants with this intestinal anomaly often associated with other anomalies (cardiac) delayed operation owing to inaccurate or tardy diagnosis inadequate supportive therapy and operative indecision or unphysiologic surgery

Early diagnosis merits special emphasis The history of vomiting of bile soon after birth, abdominal distention and gas shadows in the plain roentgenogram are usually sufficient for a presumptive diagnosis of intestinal obstruction due to a congenital anomaly Supportive therapy is necessary especially in premature infants a transfusion of 75 100 cc. whole blood should be given slowly followed by an equal amount of electrolyte solution if the baby is obviously depleted The surgeon should not make the incision until a needle is in a vein or in the bone marrow and blood is running satisfactorily no matter how good the patient's condition may seem to be Postoperatively the earlier the needs of the infant can be met through protein-containing fluid absorbed from the intestine, the less the danger of serious imbalance Penicillin seems to be the antibiotic of choice for routine use

Choice of anesthesia and incision depends on personal preference but anesthesia must be fully adequate and the incision ample. A small Levin tube or a no 8 or 10 F catheter is always inserted in the stomach for constant decompression Figure 136 illustrates the steps that should be taken for com

(4) Ann. Surg. 130 480-511 September 1949

strapped to the abdominal wall with adhesive tape

Completeness in exploration and the use of primary, definitive surgery seem to offer the best chance for survival. Partial procedures are to be avoided at all cost. Postoperative decompression is of major importance

Congenital Atresia of Small Intestine Report of Cases. Lon Grove and Earl Rasmussen[7] (Atlanta, Ga) relate experience in management of 15 patients The symptoms of small bowel obstruction in an infant varied little from those in an adult at all ages they depend on the location of the obstruction There were seven complete and four partial atresias. Projectile vomiting was a constant symptom.

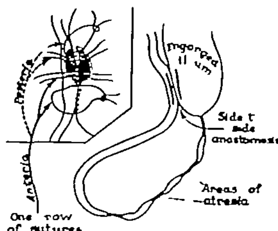


Fig. 140 —Multiple atresias of the ileum. Technic of ileocolostomy (Courtesy of Grove L., and Rasmussen, E. Ann. Surg 131 869-878 June 1950)

The patient with atresia above the ampulla had normal meconium stools, whereas those with atresias below the ampulla passed stools which were grayish white and more mucoid. X rays showed complete absence of gas below the distended point of obstruction, if the atresia was complete but when it was incomplete the gas pattern was confusing In the one patient with atresia of the jejunum and three with atresia of the ileum, vomiting was also an early symptom. At first it was bile sta d but later resembled meconium There was gene aseous distention, often associated with dilated v he abdomen.

METHOD.— erative pr ludes establishment of an electrolyt using tr n in i ated An effort

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should be made to reduce distention with a Wangensteen tube. A cannula is placed in a vein before operation is begun. Anesthesia is provided by drop ether. A liberal right rectus excision is made, with ample exposure for complete exploration of the gastrointestinal tract. When the type of obstruction has been determined the corrective procedure should be as simple as possible. The operation that best meets this requirement is a short circuit. This does not apply to cases of extrinsic obstruction in which there is danger of strangulation.

When it is feasible, duodenojejunostomy is done in cases of duodenal atresia, if not, posterior or anterior gastrojejunostomy is done. Anastomosis is done with two rows of 0000 silk sutures. No clamps are used. In most patients with low atresias, enteroenterostomy (Fig 140) is performed. Enterostomy is not performed in infants because they tolerate this procedure poorly.

Postoperatively, patients are supervised by both pediatric and surgical services, with emphasis on careful regulation of fluid and electrolyte balance, blood replacement, early detection of complications, use of the Wangensteen tube to prevent and to combat distention and liberal use of antibiotics, both preventive and corrective.

Surgery was not performed in five patients who were admitted in poor condition all died. The other 10 patients were operated on of these 1 died

Regional Enteritis

Chronic Stenosing Regional Enteritis Surgical Pathology and Experience in Surgical Treatment. Herbert R Hawthorne and Alfred S Frobese[8] (Univ of Pennsylvania) report that in 30 patients with regional enteritis or ileocolitis operated on during 14 years immediate results were encouraging but follow up study indicated that good results were not always permanent. Many patients had to be reoperated on because of recurrence or progression of the disease and others with clinical or roentgen evidence of recurrence were maintained by intense medical treatment. This series included five types of the condition classified as to location regional duodenitis jejunoileitis, terminal ileitis, ileocolitis and regional colitis. To the authors knowledge regional duodenitis has not been reported previously. Three phases of the condition were recognized acute chronic and chronic with complications (obstruction, peritonitis, abscess formation and fistulas). The complete classic gross pathologic

(8) Ann. Surg. 130 232-241 August, 1949

picture is not present in every case many variations occur and are a source of confusion in determining the limits of the disease This may contribute to the high rate of recurrence after resection, because the lesion is not always completely eradicated

In considering surgical treatment the stage of the pathologic process must be defined Operation should not be attempted in the acute stage without complications. In cases simulating acute appendicitis, exploration is advisable if the appendix is normal and there is an uncomplicated acute ileocolitis, it is best to terminate the procedure. If the picture is complicated by an abscess, drainage is necessary In surgical management of the chronic stage, two types of operation are used resection of diseased bowel with primary anastomosis, and transection of the ileum above the site of the lesion and anastomosis of the normal ileum to the colon distal to the lesion. The ileal stump just above the lesion can be closed or brought out through a stab wound as a mucous fistula to act as a safety valve if the terminal ileum is partially obstructed

Resection was performed on 24 patients, with two deaths (8 3 per cent) Five resections done less than a year ago are excluded from consideration of results One patient died of malnutrition one month after operation, and another was committed to an asylum and lost to follow up Among the other 15 patients who were followed for 1 14 years, there were 11 recurrences (73 per cent) These discouraging *results led the authors to use ileocolostomy* with exclusion of the diseased bowel in six complicated cases in the past two years Four patients have remained symptom free for two years Presence of widespread mesenteric lymph node involvement is an indication for the exclusion operation. Patients with extensive involvement of the small intestine or multiple "skip areas" should be treated conservatively In the occasional case of involvement of the colon from the ileocecal area to the sigmoid the authors perform ileostomy well above the site of the disease, if the lesion becomes quiescent and does not progress into the distal sigmoid, restoration of bowel continuity by ileosigmoidostomy may be attempted It is wise to observe these cases for two to three years before restoring the continuity

As a result of their experience, the authors believe that surgical intervention should be limited to cases complicated by obstruction abscess and fistulas and those in which thorough medical regimen has failed.

[There is abundant evidence that this disease usually is psychosomatic in origin. The surgeon will do well to have a good psychiatrist see the patient. The late stages and complications of course often require surgical management, but recurrences such as those mentioned in this article can often be prevented by good psychiatric advice.—Ed.]

Management of Chronic Regional Ileitis Everett D Kiefer, Samuel F Marshall and M. P Brolsma[9] (Lahey Clinic) treated 33 patients medically and 126 surgically Indications for medical management were localized disease of short duration, without complications such as obstruction, fistula or abscess, and uncomplicated but widespread disease involving so much small intestine that removal of all of the affected portion would seriously impair absorption. The principles of nonspecific supportive management are (1) body rest, (2) adequate nutrition (3) reduction of intestinal activity (4) correction of secondary systemic effects such as anemia dehydration and hypoproteinemia, and (5) control of infection. Under this regimen five patients had been well 5 11 years at the time of writing Surgery was advised for 18 who were unrelieved or had early exacerbations. A single patient has some disability but was improved. There were nine patients for whom medical management was undertaken because involvement was too extensive for surgical resection four had been in good health for three to nine years at the time of the report, two were much improved, two were invalids and one was dead

In surgical treatment of chronic regional ileitis, radical resection of the diseased intestine with its mesentery and adjacent lymph nodes is preferred. If the terminal ileum is resected, the cecum and ascending colon are always included. In this series there were two postoperative deaths both were due to pulmonary emboli. Recurrent ileitis was diagnosed or suspected in 43 of 102 patients followed postoperatively over two years The more extensive the original disease the more likely was recurrence The incidence of postoperative complications severity of symptoms and pathologic changes did not seem related to recurrence

(9) Gastroenterology 14 118-130 January 1950

Diagnosis of recurrent regional ileitis is based on the same clinical, laboratory and x ray features that characterize the primary disease An estimate of the activity of the process may be made from symptoms and blood studies which may show hypochromic anemia If medical treatment does not control or arrest the disease, surgical resection may be indicated Surgery should also be used for recurrent obstruction, fistula or abscess formation. The value of x ray therapy over the abdomen cannot be fully estimated from this study Although no exact figure is available, the total resected small intestine should not exceed 72 in., for more extensive removal may result in serious nutritional disabilities.

Systemic Effects

Experimental Production of Macrocytic Anemia by Operations on Intestinal Tract D G *Cameron*, G M *Watson* and L J Witts[1] (Radcliffe Infirm, Oxford, England) found that macrocytic anemia could be produced in adult albino rats by creating in the upper or middle third of the small intestine a blind loop which is filled by the action of peristalsis. Of 104 animals which survived the immediate effects of this operation, 42 had macrocytic anemia after an average of 74 days Once the anemia appeared it was progressive and almost invariably fatal within a month if untreated Examination of stained blood films showed well marked macrocytosis, anisocytosis and diffuse polychromasia. Nucleated red blood cells, chiefly polychromatic normoblasts, were often seen, but no megaloblasts were observed. In every instance the Price-Jones curve exceeded the ideal These findings clearly demonstrated that the anemia was macrocytic Hemoglobin readings ranged from 9 9 Gm /100 ml. to 2.7 Gm./100 ml normal for the rats being 14 Gm Marrow smears from rats with macrocytic anemia showed normal or increased cellularity There were increased numbers of proerythroblasts and basophil erythroblasts but no cells which corresponded exactly with the megaloblasts of human pernicious anemia. Although the mechanism which causes macrocytic anemia in these animals is unknown, it

(1) [illegible] July, 194[illegible]

is probably dependent on stagnation in the blind loop and a change in the bacterial flora of the small intestine

Clinical Association of Macrocytic Anemia with Intestinal Stricture and Anastomosis is presented in a case report by D G Cameron, G M Watson and L J Witts[2] (Radcliffe Infirm., Oxford, England)

Woman 42, first had symptoms of acute intestinal obstruction in 1938 which were relieved by anastomosis of adjacent loops of ileum. Her mother was known to have pernicious anemia. In 1939 severe hyperchromic anemia with a hemoglobin value of 5.9 Gm. per cent developed. The blood film showed macrocytosis, anisocytosis and poikilocytosis. Treatment with an oral liver preparation was very effective. In 1943 liver extract for oral use was unavailable, and despite intensive intramuscular therapy the patient had sore tongue, indigestion and weight loss and anemia recurred. There were abdominal discomfort and distention and paresthesia of hands and feet. On hospitalization in April 1944 she had extensive edema of the legs, the abdomen was distended and peristalsis was visible and noisy Hemoglobin value was 9.5 Gm., erythrocytes numbered 2,030,000 and the color index was 1.2. The mean cell volume was 125 cu. μ and the mean cell diameter 8.24 μ Sternal marrow was active with both normoblastic and megaloblastic hemopoiesis. Free hydrochloric acid was present in the stomach and was also detected in 1947 Fecal fat output over three days on a constant diet was within normal range X rays taken after a barium meal showed relative small bowel obstruction with hypermotility At operation the previously excluded coil of bowel was found to contain several strictures with intervening musculature greatly dilated and hypertrophied. The mesentery was thickened in a way similar to that of regional ileitis, but the bowel wall was not as rough and appeared whiter The excluded loop was resected and a side-to-side anastomosis done. After operation recovery was satisfactory in all respects, and the patient remained well a little less than a year

In October 1945 the hemoglobin value was 5.6 Gm. per cent. Since she had previously become sensitive to liver she was desensitized and intramuscular treatment was resumed. She remained well until April 1947 when she complained of weight loss, but the hemoglobin was 11.6 Gm per cent. X ray examination showed changes in the small bowel pattern which strongly suggested extensive recurrence of the original lesion. She was given a low residue, high protein diet, extra vitamins and liver extract intramuscularly By May 1948 she had regained 6 kg and was relatively free from symptoms

In general, the blood picture in these anemias closely resembles that of pernicious anemia in that hyperchromia, macrocytosis and anisocytosis are prominent features. The

(2) Blood 4 793 802 July 1949

fortuitous association of pernicious anemia with gross intestinal disease is unlikely because of the repeated finding of free hydrochloric acid in the gastric juice and the failure to respond to intramuscular liver therapy until surgery had been performed Megaloblastic transformation may be seen in the marrow resembling that of pernicious anemia, but the change may be of a lesser degree In this and eight cases collected from the literature, surgical correction of the intestinal abnormality led to cure of the anemia, establishing a direct relation between them Steatorrhea is apparently not necessarily associated with macrocytic anemia of intestinal origin, since in this and other cases it has been absent. The anemia is probably due to stagnation of intestinal contents and absorption of toxic substances.

Tetany from Small Bowel Resection and Small and Large Bowel Exclusion. Lloyd D Mayer and Leo H. Criep[3] (Pittsburgh) *report a case.*

Youth, 17, had an intestinal absorptive surface area of 4-6 ft. small intestine and less than half of the large intestine. He was given daily 6 Gm. calcium, 50,000 units of vitamin D, vitamin B complex vitamin C, 6 Gm. ammonium chloride and a diet of 350 Gm. carbohydrate, 150 Gm. protein and 60 Gm. fat. He also received tincture of deodorized opium and bismuth subcarbonate. Serum calcium level rose from 6.8 to 9.5 mg per cent, serum protein level ranged from 6.3 to 6.9 Gm. per cent, albumin fraction rose from 3.3 to 4 Gm., and the globulin from 2.3 to 2.9 Gm. The phosphorus level fell from 5 6 to 3.3 mg per cent. Nonprotein nitrogen content was 34 mg per cent, serum chloride 582 mg per cent and carbon dioxide-combining power, 54 volumes per cent. For one week after admission, the patient continued to have intermittent carpopedal spasm, which was relieved by parenteral calcium injections. Finally he was stabilized by giving 12 Gm. calcium gluconate daily in addition to described medication He was discharged after 37 days and was still fairly well 32 weeks later

This is obviously an instance of disturbed calcium metabolism due to deficient gastrointestinal calcium absorption. Calcium is absorbed chiefly from the upper portion of the small intestine Its absorption depends on the pH of the contents of the gastrointestinal tract, amount of phosphates and fat in the diet and presence of vitamin D Since calcium salts are relatively insoluble in alkaline mediums, their absorption is greatly enhanced by the addition of acidify

(3) Gastroenterology 13:597-602 December 1949

ing salts such as ammonium chloride Since calcium is absorbed in the duodenum before gastric juice is neutralized, pH of the duodenum plays an important part. An increased amount of phosphate, magnesium and potassium inhibits the absorption of calcium, whereas disturbances of fat absorption and increased fat excretion result in the formation of insoluble calcium soaps Other controlling influences are exercised by serum proteins, parathyroids and kidneys The fat in the patient's diet was not completely absorbed, and this resulted in the elimination of foamy, light-colored, pasty stools.

Results of biochemical studies by others and the clinical observations of the authors in this case indicate that a diet high in carbohydrate and protein but low in fat should be used in treating tetany due to extensive bowel resection. The diet should also contain large amounts of calcium, especially calcium chloride, and a proportionately lower concentration of phosphorus, magnesium and potassium. An acidifying salt should be used to promote absorption of calcium, vitamin D should be replenished, preferably in a nonoily form Paregoric and belladonna are useful in delaying transport and thus allowing for further absorption Close postoperative observation of the calcium level of patients who have undergone extensive small and large bowel surgery is indicated

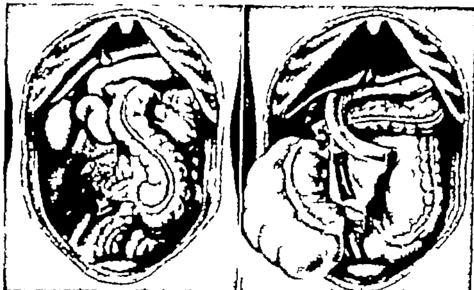
ANOMALIES

Surgical Significance of Anomalies of Intestinal Rotation. Clarence E Gardner Jr.,[4] (Duke Univ) states that the intestinal tract of the early embryo is a straight structure suspended in the sagittal plane on the common dorsal mesentery The process by which this primitive position is converted to that seen at birth is called intestinal rotation. The midgut loop which runs from the duodenojejunal junction to midtransverse colon, is primarily concerned in intestinal obstruction in patients with anomalies of intestinal rotation. Some anomalies may not produce symptoms, being detected only by x ray examination at operation or when the appendix is found in an anomalous position. If

(4) Ann. Surg 131 : 9 979 June 1950

symptoms occur, the usual ones are those of partial or complete intestinal obstruction.

About the eighth week of intrauterine life the first stage



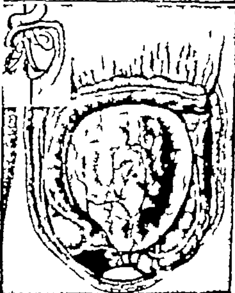


Fig 141 (above left) —Nonrotation. The midgut loop has not rotated. Disposition of the viscera is essentially the same as at the end of the first stage of *rotation except that the bowel has returned* to the abdominal cavity Colon is entirely on the left and small bowel on the right of the abdominal cavity

Fig. 142 (above right) —Reversed *rotation. A 180 degree clockwise in*stead of a contraclockwise rotation has occurred. Transverse colon thus lies under the superior mesenteric artery while the duodenum passes in front of it. *Subsequent fixation of the mesenteric root* has trapped the colon under it.

Fig 143 (left) — Internal hernia. Most of the small intestine is enclosed in a peritoneal sac. When the midgut is *reduced from the temporary umbilical* herniation, the bowel bulges into its own post arterial mesentery (insert) instead of entering the free peritoneal cavity Wall of the sac is thus the *mesentery of the terminal ileum and* ascending colon.

(Courtesy of Gardner, C. E., Jr: Ann. Surg 121 879 898 June 1960)

of intestinal rotation occurs The midgut loop bulges through the umbilical orifice into the primitive umbilical cord and rotates contraclockwise 90 degrees from the sagittal to the horizontal plane Failure of rotation beyond this point and

retention of the loop in the umbilical stalk beyond the time of birth is called an omphalocele The hernial covering of the thin translucent umbilical cord structure may enclose



Fig 144 (above left).—Abdomen of infant aged 2 months, with signs of chronic duodenal obstruction since birth A 360 degree clockwise rotation of midgut loop about the mesenteric root has occurred. Duodenum is obstructed at the volvulus and is dilated above it. Small bowel loops are not distended.

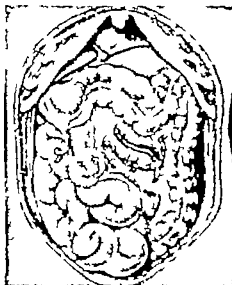
Fig 145 (above right).—Abdomen of same infant after reduction of volvulus. Mesentery and bowel of the entering loop of jejunum and emerging loop of colon are adherent Sometimes adhesive bands also cross the duodenum in the region of the upper arrow

Fig 146 (left).—Abdomen of same infant after separation of adherent bowel and mesentery of entering and emerging loops of the volvulus. Veins are distended and mesenteric lymph nodes are enlarged by the chronic obstruction. Bowel is replaced in this position at the end of the operation. Duodenum descends on the right of the vertebral column and all small bowel is on the right. Colon is entirely in the left side of the abdomen. This is the position of nonrotation.

(Courtesy of Gardner C E, Jr: Ann. Surg 131 879-898 June 1950.)

the liver or spleen with the intestine To prevent evisceration, it is necessary to close the defect as soon as possible after delivery

The most important stage of intestinal rotation is the second when the midgut loop returns to the peritoneal cavity and rotates an additional 180 degrees contraclockwise



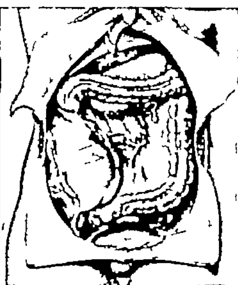




Fig. 147 (above left) —Subhepatic cecum. Since fixation of cecum and ascending colon in the right flank has not occurred, the mesentery of the small intestine fails to attain a broad fixation to the posterior abdominal wall from left upper to right lower quadrants and remains suspended from a narrow pedicle at the origin of the superior mesenteric artery. This may predispose to volvulus of the entire small intestine.

Fig 148 (above right) —Volvulus of the cecum. The cecum and ascending colon are mobile and have twisted 180 degrees in a clockwise direction about the long axis of the ascending colon. The cecum is distended. Small bowel also usually becomes distended. Barium introduced by rectum would show a block at the hepatic flexure.

Fig 149 (left) —Mobile cecum. Four hypothetical positions a mobile ileocecal segment may occupy in the abdomen. The mobile cecum may predispose to volvulus of the cecum. Its most dangerous consequence may be from the anomalous position of the appendix.

(Courtesy of Gardner C. E. J : Ann. Surg 131:879-898 June 1950)

so that the intestinal tract comes to occupy the position normally seen at birth. Anomalies of the second stage include nonrotation (Fig 141) volvulus of the midgut (Figs 144-146) malrotation, internal hernia (Fig 143) or reversed

rotation (Fig 142) At operation for volvulus the following procedures are necessary (1) evisceration (2) detorsion of the volvulus and (3) release of adhesions uniting entering and emerging loops of bowel and of adhesive bands which may run across the duodenum The bowel is then returned to the abdomen in a position of nonrotation, with the small intestine in the right side of the abdomen and the colon on the left Internal hernia is an irregularity of rotation in which the midgut loop rotates into its own mesentery Since the wall of the hernial sac is the mesentery of the ascending colon and terminal ileum its vessels must not be disturbed at operation

The third stage of midgut rotation is characterized by descent of the cecum from its subhepatic position to the right lower quadrant and fixation of the mesentery of the cecum and ascending colon in the right flank Fixation of the descending colon and lower portion of duodenum also occurs in this stage, which is completed about the time of birth Anomalies include subhepatic cecum retrocecal appendix and mobile cecum (Figs 147 149) The most important feature of these abnormalities is that the appendix may be in an anomalous position.

Blind Intestinal Pouches Resulting from Lateral Anastomoses were observed in eight patients by Carl J Heifetz and H R. Senturia[5] (St Louis) In five the pouches produced symptoms in three who were asymptomatic they were found incidentally When side to-side intestinal anastomosis is performed after division of the bowel, the blind end of the afferent segment tends to dilate Development of a pouch may be dependent on the length of the segment left distal to the anastomosis, tonicity of intestinal wall, positioning of replaced loops or stasis created by division of the circular muscle fibers Although the frequency of this complication cannot be ascertained, it is probable that most of these lesions occur asymptomatically and are of little therapeutic concern.

Symptoms include weakness, inability to gain weight colicky abdominal pain, distention borborygmus, nausea and vomiting diarrhea, nutrition disturbances and anemia

(5) Surgery 27:672-687 May 1950

The most important stage of intestinal rotation is the second when the midgut loop returns to the peritoneal cavity and rotates an additional 180 degrees contraclockwise

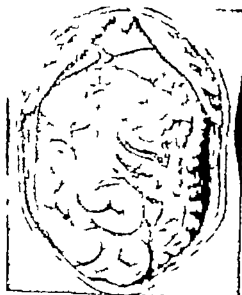






Fig 147 (above left) —Subhepatic cecum. Since fixation of cecum and ascending colon in the right flank has not occurred, the mesentery of the small intestine fails to attain a broad fixation to the posterior abdominal wall from left upper to right lower quadrants and remains suspended from a narrow pedicle at the origin of the superior mesenteric artery. This may predispose to volvulus of the entire small intestine.

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(5) Surgery 27:673-687 May 1950

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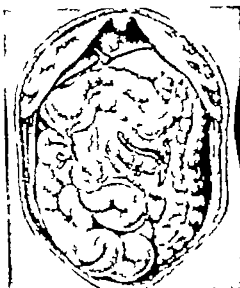




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Symptoms include weakness inability to gain weight, colicky abdominal pain, distention, borborygmus, nausea and vomiting diarrhea, nutrition disturbances and anemia.

(5) Surgery 27:673-687 May 1950

Complications which warrant treatment are perforation with peritonitis, intestinal obstruction, nutrition disturbances and severe anemia X rays may aid in diagnosis of blind pouch.

If the symptoms interfere with the patient's well being and are due to a blind pouch, surgery is necessary The blind pouch may either be removed or the entire area resected and end to-end anastomosis performed. Although local technical considerations may dictate the choice, resection is preferred because it leaves no chance for the pouch to recur Blind pouches will not occur if end to-end union is substituted for lateral anastomosis at the original operation

Diverticula of Small Intestine E S J King[6] (Melbourne) presents observations based on study of 32 of these diverticula found at 5,000 autopsies and 5 obtained at operation. Most of them were found in patients over 40 the greatest incidence being in the seventh decade There were 27 males

These diverticula are found along the length of the small bowel about seven times more commonly in the jejunum than in the ileum. They are more commonly multiple

In young persons diverticula are usually single They have a wall of the same thickness as the neighboring bowel and the muscle is in well formed layers The mucosa may be intestinal or gastric in type or may contain pancreatic tissue The diverticula usually occur on the mesenteric border or close to it In the ileum any diverticulum on or near the antimesenteric border is assumed to be of the Meckel type

In adults diverticula are usually spherical structures and may vary from 2 to 3 mm in diameter to large protuberant cysts 9 10 cm. in diameter They may be placed so closely together that as they enlarge they coalesce The majority are found at or near the mesenteric border and these may project into and separate the two layers of the mesentery In the upper part of the jejunum diverticula project more anteriorly Those that arise near but not at, the mesenteric attachment develop on the right rather than on the left side of the gut In the lower part of the bowel diverticula arise

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(6) Australia & New Zealand J Surg 10 301 319 May 1940

from the bowel on both sides of the mesentery. The minority of diverticula arise well away from the mesenteric attachment. An artery and a vein usually run from the mesentery over the surface of the diverticulum to enter the bowel wall.

In adults the thickness of the diverticular wall is related mainly to the size of the diverticulum. The smaller diverticula have thicker walls and contain muscle tissue corresponding to the coats of the normal intestine. Disappearance of muscle seems to be a gradual process associated with distention of the sac. Larger diverticula have walls consisting of mucous membrane and connective tissue. The opening of the diverticulum is usually large so that there is a free communication with the lumen of the gut. The contents of a diverticulum are usually fluid, and stasis seldom occurs.

Diverticula are frequently associated with regional ballooning of the adjacent intestine. Many symptoms such as abdominal pain and discomfort, colic and constipation are due to the associated "atony" of the gut and may disappear after treatment of the diverticulum. Important complications are infection of the sac and its sequelae, traumatic rupture of a diverticulum and obstruction of the intestinal lumen.

The cause of the weakening of the intestinal wall which results in diverticula is unknown.

NEOPLASM

Carcinoma of Jejunum and Ileum Exclusive of Carcinoid Tumors. James E. Pridgen (Mayo Found.), Charles W. Mayo and Malcolm B. Dockerty[7] (Mayo Clinic) reported clinical, pathologic and surgical results in 44 tumors of jejunal and 19 of ileac derivation. Average age of the patients having adenocarcinoma was 49.2 years. The male to female ratio was 2:1 in those with carcinoma of the jejunum but sex distribution was almost equal in carcinoma of the ileum. Symptoms related to anemia were seen in 66 per cent in the jejunal series and in 74 per cent in the ileac series. Features suggesting partial or complete obstruction of the small bowel were common and occurred in 70 per cent of those with jejunal lesions and 79 per cent of those with

(7) Surg., Gynec. & Obst. 90:513-524, May 1950.

ileac lesions. Symptoms suggesting perforation were seen in 14 per cent and 21 per cent in the two series. A palpable mass was present in the jejunum in 41 per cent and in the ileum in 48 per cent. Visible peristalsis was noted in 33 per cent of the ileac series and 26 per cent of the jejunal series Average weight loss for both groups was about 25 lb

In 1942-46 x ray studies of the small bowel were made in 76 5 per cent of the cases seen and 92 3 per cent of these studies were diagnostic

In the jejunal group there were 80 annular constricting 8 irregular ulcerative and 3 polypoid lesions Similar group-

ADENOCARCINOMA OF JEJUNUM AND ILEUM—SURVIVAL RATES

	Site		Total
	Jejunum	Ileum	
Patients operated on 1944 or earlier	36	19	55
No. traced	32	18	50
3 yr survivals	12	5	17
% of traced patients	37.5	27.8	34.0
Patients operated on 1942 or earlier	32	17	49
No. traced	29	17	46
5 yr survivals	8	3	11
% of traced patients	27.6	17.6	23.9
Patients operated on 1937 or earlier	22	11	33
No. traced	21	11	32
10 yr survivals	3	1	4
% of traced patients	14.3	9 1	12.5

ing of ileac lesions gave figures of six, three and three, respectively In 10 cases the gross type was undetermined. In general, lymph node involvement was directly related to the grade of the lesion. More lesions were of high than of low grade There were several large high grade lesions without lymph node involvement, supporting the concept that, regardless of grade, tumors may be of two types those which spread by extension and those which spread by vascular route The number or size of nodes present at operation did not prove a reliable index to metastatic involvement on microscopic examination.

Wide resection of the lesion with removal of regional lymph nodes is the treatment of choice and was performed in 73 per cent of jejunal and 68 per cent of ileac cases. A

palliative short circuit operation which diverts the fecal stream around the growth is of value if resection is impossible Over all operative mortality varied from 55.5 per cent in 1907 17 to 3.2 per cent in 1937-47 Survival rates are shown in the table Average postoperative duration of life was 30 8 months in the jejunal and 34 8 months in the ileac series

SURGICAL PROCEDURES

Use of Abdominal Flap Graft in Construction of Permanent Ileostomy Clarence W Monroe and John H Olwin[8] (Chicago) found that an ileostomy covered with a split

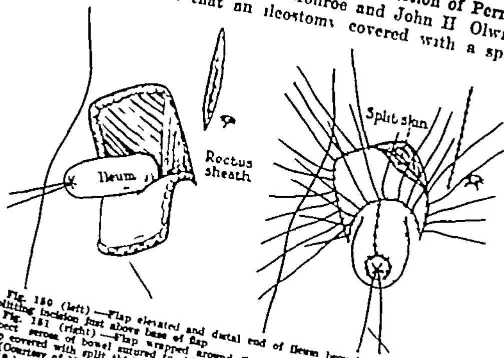


Fig. 150 (left) —Flap elevated and distal end of ileum brought through muscle-splitting incision just above base of flap

Fig. 151 (right) —Flap wrapped around ileum and sutured to itself on dorsal aspect serosa of bowel sutured to skin of flap at its distal open end; donor site of flap covered with split thickness skin graft.

(Courtesy of Monroe, C. W., and Olwin, J. H. Arch. Surg. 59 565-572 September 1949)

thickness graft contracted in 18 months from its original 3½ in. length to ¼ in. Thinking that the resistance of a full thickness flap graft containing fat, fascia and its own blood supply would be much greater and that the possibility of later contraction might be practically eliminated, they used the following procedure in a patient with familial polyposis involving the entire colon.

(8) Arch. Surg. 59 565-572 September 1949

TECHNIC.—Through a right upper paramedian incision the terminal 6 in. of ileum, the right colon and half to two thirds of the transverse colon were resected. The distal 6 in. of remaining ileum, the opening of which had been closed with a purse-string, was mobilized by severing the vessels just below the distal arches. A skin flap 4 in. long and 3½ in. wide was elevated in the right lower abdominal quadrant, the base being directed downward. A muscle-splitting incision was made through the abdominal wall (Fig. 150) just above the center of the base of the flap and the ileum brought through this wound. The skin flap was wrapped around the ileum and the skin edges were approximated with interrupted fine surgical gut in the subcutaneous tissue and Nylon in the skin. The ileostomy was not opened, but its serosa was sutured directly to the skin edges about the distal end of the newly constructed tube. The donor site of the flap was covered with a split thickness skin graft from the thigh (Fig. 151) and the graft immobilized by tying the sutures, which were left long over a stent of Nylon fabric and moist cotton. The paramedian incision was closed and a soft bulky pressure dressing applied. The ileostomy remained closed for seven days. When the dressing was removed from the split skin graft on the eighth day it had taken almost completely. Subsequently, three or four small areas within the graft broke down (Fig. 152) but healed promptly. There was some sloughing of the wall of the ileum where it was sutured to the skin of the flap, but when this had healed the ileostomy stoma rested about 2 in. beyond the abdominal wall



FIG. 152.—Appearance 11 days after ileostomy. Major portion of split thickness graft in donor site of flap has taken well. Small slough of margin of ileum has not yet completely separated to leave skin-mucosa junction. (Courtesy of Monroe, C. W., and Olwin, J. H.: Arch. Surg. 59:565-572, September 1949.)

A suitable prosthesis was devised which fits such an ileostomy and provides for satisfactory collection of bowel contents

Construction of Grafted Ileostomy or Colostomy Stoma Using Abdominal Wall Flaps is described by Kenneth L Pickrell, John Wilde, T Ray Broadbent, James T Metzger and Benjamin F Edwards[9] (Duke Univ) Complications following ileostomy may be frequent and include fistulas and secondary openings proximal to the stoma, erosion of free skin grafts with resultant contracture deformity, contraction and shrinkage of the ileum, ileum prolapse because of motility of the mesentery, and stricture at the neck of the stoma from contraction of the circular scar. These complications emphasize the importance of adding refinements to any procedure for their prevention. For this reason the technic of Dragstedt, Dack and Kirsner in which a spigot is created from exteriorized ileum by applying a thin split skin graft to the serosal surface of the protruding ileum has been modified so that heavy full thickness abdominal wall skin and subcutaneous tissue flaps are used to cover the exteriorized segment of ileum or colon. Similar flaps have been used to cover exteriorized esophagus.

Flap grafting the exteriorized segment may be completed in a single operation, using one of several methods. Two short single pedicle flaps, one medial and one lateral to the exteriorized segment, may be used (Fig 153). The spigot should extend a minimum of 2 in., preferably 3 in., beyond the normal contour of the abdomen. The lines of incision for the flaps are placed in an oblique plane to enhance closure of the abdominal wall without tension. Satisfactory surfacing can also be accomplished by using opposing single pedicle flaps (Fig 154). Trimming of the triangular areas should be deferred until the flaps are approximated, when it may be necessary to excise but little. Unless there is considerable redundancy of the abdominal wall, laterally placed pedicles should not be used because of fixation of the umbilicus and consequent difficulties in closing the abdominal wall. A single pedicle direct transfer wrap around flap

(9) Plast & Reconstruct. Surg 5 284 291 May 1950.

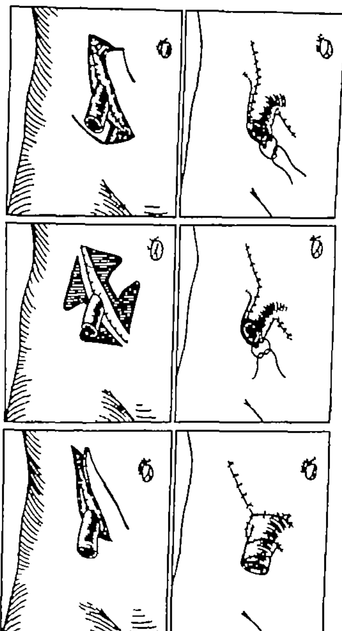


Fig. 153 (top) —Flap grafting exteriorized segment of intestine with two short single pedicle flaps.
Fig 154 (center) —Opposing single pedicle flaps.
Fig. 155 (bottom) —Single pedicle direct transfer wrap around flap.
(Courtesy of Pickrell, K. L., *et al*: Plast. & Reconstruct. Surg. 5 384 391 Ma 1950)

may be used (Fig 155) When using an inferior pedicle the flap should be planned so as to include the inferior epigastric artery as the source of blood supply The donor area and

abdominal incisions are closed primarily, after which the flap is wrapped around the exteriorized segment. Circular constriction of the stoma is more likely to occur when using a single flap to construct the spigot. The constriction, however, may act as a very useful sphincter in aiding the patient with care of the personal toilet.

This procedure aids in preventing complications. Its greatest advantage is absence of painful skin excoriation. The spigot like construction facilitates direct transfer of intestinal discharge into the bag without leakage or spillage onto the surrounding abdominal wall. Pastes, ointments and skin varnishes are unnecessary. Since back spillage may occur when the patient sleeps on his back, he should learn to sleep on one side with the bag hanging dependently. Daytime dress and personal toilet present little or no difficulty. Because of the full thickness of skin and subcutaneous tissue, the surface of the exteriorized flap has better thickness and quality and will withstand trauma. Rotation of the stoma is prevented because the bases of the flaps are fixed, but mobility of the spigot is unrestricted in all positions.

Use of Free Peritoneal Grafts in Intestinal Anastomoses is described by Spencer T. Chester, H. Glenn Bell and H. J. McCorkle[1] (Univ. of California). End-to-end anastomosis of the colon was performed in 16 anesthetized dogs. Free peritoneal grafts (Fig. 156) were placed around the anastomoses, peritoneal side down, after the graft had been moistened with thrombin solution and the intestine at the site of anastomosis had been moistened with serum. The graft was sutured in position with interrupted no. 100 cotton sutures (Fig. 157).

There were no deaths and no evidence of peritonitis in any of the dogs. In a control group of eight animals results were similar. Grafts were examined 3 and 120 days postoperatively. All were viable, and the outer raw surface was covered with epithelium as early as the twelfth day. In most animals the graft was covered with omentum, small intestine or mesentery. There was no evidence of stricture at the site of anastomosis or of dilatation or hypertrophy.

(1) Surg., Gynec. & Obst. 89 604-608, November 1949.

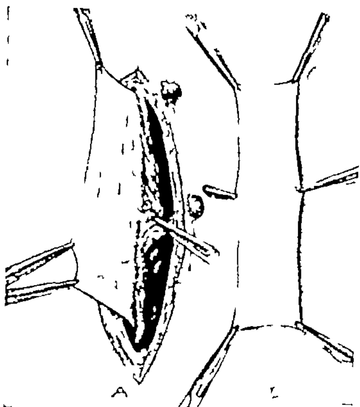


Fig. 156.—*A*, removal of peritoneal graft from lateral edge of laparotomy wound; *B*, peritoneal graft after removal from abdominal wall. (Courtesy of Chester, B. T., *et al.*: Surg., Gynec. & Obst. 89:603-608, November 1949.)



Fig. 157.—*A*, placing of graft around site of anastomosis. *B*, free peritoneal graft sutured in position around site of anastomosis. (Courtesy of Chester, B. T., *et al.*: Surg., Gynec. & Obst. 89:603-608, November 1949.)

of the intestine proximal to the anastomosis. Microscopic examination showed the usual stages of healing.

In these experiments serum thrombin was used, but plasma thrombin may be preferable because of the immediate sealing and fixing effect. The peritoneal side of the graft was placed next to the anastomosis because healing occurs best where there is apposition of peritoneal surfaces. The main objection to this procedure is that adhesions form on the exposed unperitonealized surface, and for this reason experiments are being performed in which the raw surface of the graft is placed next to the intestine.

[When the omentum is sutured to the line of anastomosis no stricture develops, probably for the same reasons that a stricture does not follow the use of a peritoneal graft.—Ed.]

VERMIFORM APPENDIX

Morbid Factors in Experimental Appendicitis. Carlos A. Tanturi and Raymond F. Anderson[2] (Northwestern Univ.) found that experimental appendical peritonitis in the dog is a disease in which local release of bacterial enzymes and toxins from the gangrenous organ is of more significance in the morbid process than any alteration of circulating prothrombin or derangement of fibrinolytic antifibrinolytic equilibrium in the circulating blood. Ninety two per cent of dogs will recover from this disease when a simple Polythene bag is placed over the ligated appendix and the gangrenous exudate removed in 72 hours. Removing the gangrenous appendix at 48 hours when no bag has been placed over it results in 100 per cent mortality after the second procedure. This points to the local area as of basic importance and early surgical removal of this focus should be the fundamental rule in surgical treatment of the disease.

The inability of 75 per cent of a control series naturally to wall off the gangrenous appendix probably depends on the action of two bacterial enzymes identified in the gangrenous exudate. Streptokinase prevents fibrin deposition about the necrotic appendage by its lysing effect on this

(2) Surg. Gynec. & Obst. 89 165-180 August 1949

protective barrier Hyaluronidase provides a mucolytic and a spreading factor which makes possible dissemination of bacteria into the general peritoneal cavity

Lecithinase, the lethal factor of the alpha toxin of Clostridium welchii, was identified in 89 per cent of gangrenous appendical fluids. This enzyme produces a severe toxemia by its absorption into the circulation. The inability of commercial gas gangrene antitoxin to inhibit the lecithinase produced by the clostridium of the dog has been demonstrated Serum of convalescent dogs or of dogs which have been inoculated with their own fecal matter inhibits the splitting of lecithin. Although no single factor can account for the death from peritonitis, the lethal toxin of Cl. welchii can be held primarily responsible for the alterations in hemodynamics, hepatic functions and metabolic status seen in the course of the disease These changes are systemic reflections of the local disease mechanisms and although contributory to eventual death, do not represent the essential factors in the pathogenic picture

The action of sulfonamides and antibiotics in aborting the disease process probably depends on the destruction of certain bacteria present in the exudate, thus preventing a synergistic growth necessary for the production of metabolites needed for lethal enzyme production. Histamine studies before and after injection of bag fluid indicated that death from this type of experimentation results from peptone like shock before any toxemia from the lecithinase present can become manifest

Appendicitis E T Thieme[3] reviewed treatment of appendicitis at St Joseph's Mercy Hospital, Ann Arbor, Mich., during 1935-44. This period was chosen because the first five years represent the introduction of intravenous fluids, continuous gastric suction, more frequent blood transfusions and certain changes in surgical technic the second five years had the added advantage of the sulfonamides, but penicillin was not yet used. The two periods lend themselves to certain comparisons of treatment methods and results. During this time 2 179 patients were treated for

(3) Arch. Surg 59 514-526 September 1949

appendicitis 913 (41 9 per cent) were treated for recurrent or interval appendicitis without a death 1,266 were treated for suppurative appendicitis with a mortality of 1 9 per cent but of these, 225 (10 4 per cent) showed no suppurative appendicitis microscopically or had another disease which was found at operation there were 2 deaths This leaves 1 042 (47 7 per cent) treated correctly for suppurative appendicitis with a mortality of 2.1 per cent

Improvement was noted in the second five years Thieme reviews the variable factors to determine the cause of this improvement. The incidence of complicated cases was 26 1 per cent in 1935-39 and 25 9 per cent in 1940-44 The interval from onset of symptoms to operation was the same The higher mortality in advanced age groups is pointed out, but the age distribution was also the same Use of drainage was greatly curtailed without harm to the patient and with great improvement in morbidity but probably little effect on mortality The right rectus incision was largely abandoned for the muscle splitting incision in the right lower quadrant but this change could not be evaluated adequately

Thieme discusses the problems of diagnosis from the standpoint of correlation of the pathologist s report with the clinical picture Acute suppurative appendicitis with purulent exudate in the lumen and pyogenic cellular infiltration of the wall was taken as the minimal criterion for clinical diagnosis of the disease On the basis of this rigid standard it was found that 187 (15 per cent) of the patients operated on did not have appendicitis Other abdominal conditions encountered were pelvic, genitourinary gastrointestinal and miscellaneous disorders Though more accurate diagnosis could greatly improve results, this was not a factor in lowering the mortality Postoperative generalized peritonitis was almost eliminated during the second five years

Over all mortality dropped from 2 6 per cent in the first five years to 1 1 per cent in the second Use of the sulfonamides was given greatest credit for this with the conservative treatment of abscess and peritonitis a contributing factor To improve results further more accurate diagnosis and more effective treatment of the aged are needed

Acute Appendicitis in Pregnancy Edwin S Hoffman and Masamichi Suzuki[4] (Detroit) reviewed 52 appendectomies done on pregnant women in Grace Hospital during 1943-47 36 4 per cent of the appendixes were freely movable, and 63 6 per cent were retrocecal or fixed by adhesions. There were 22 cases of pathologically proved acute appendicitis and 1 diagnosed on clinical evidence only Thirteen patients had had one or more previous attacks

The symptoms are the same in the gravid as in the non gravid patient, but as pregnancy advances, the pain is higher and more lateral. The usual symptoms are present in most cases, but their interpretation in the last trimester may be difficult because of displacement of the appendix and cecum.

Before the patients left the hospital the abortion and premature rate was 17 4 per cent. The subsequent course of pregnancy after discharge was followed in 18 women, of whom 16 have delivered 31 2 per cent had an abortion or premature labor and 68 8 per cent delivered at term. Fetal mortality during the acute phase of the illness was 17 4 per cent. When the disease was limited to the appen dix fetal loss was 7.2 per cent when it had spread beyond the appendix, mortality increased to 33.3 per cent Over all fetal mortality was 42 9 per cent One mother died.

All pregnant patients should be closely watched for signs and symptoms of acute appendicitis, especially if there is a history of previous infection. In doubtful cases, it is best to operate especially during the first six months In women who have had attacks of appendicitis, appendectomy should be done particularly if the patient is contemplating mar riage. During the first six months, appendectomy is the procedure of choice Maternal mortality is not increased and the diagnosis is not difficult During the last trimester operation is indicated even in doubtful cases because it is better to take out an innocent appendix than to miss an acute one When the appendix has been perforated more than eight hours and there is evidence of spreading peri tonitis, conservative management with antibiotics (penicil lin and streptomycin) is desirable

(4) West. J Surg. 58 147 148 April 1950

Appendicitis in Old Age II Max Schiebel and Davis Moses[4] analyzed 53 cases of appendicitis in patients aged 60 and over treated at Watts Hospital Durham, from 1937 to 1947 70 per cent were between 60 and 69 6 were 75 or older and 1 was 90 In 31 the appendix had ruptured Pain was present in all cases nausea and vomiting were less frequent than anorexia which occurred in 93 per cent Diarrhea occurred in six cases only and the appendix was ruptured in all six There was tenderness in the right lower quadrant in all cases Only four patients were undernourished, and none were debilitated Admission temperatures varied from 97 6 to 103 8 F In patients of this age group a temperature above 100 F may be regarded as presumptive evidence of rupture The leukocyte count varied from 5 700 to 30 000

McBurney incisions were used in 68 per cent. Of the patients who died 71 per cent had had a rectus incision. Drainage was used in all but three cases of rupture There were no postoperative abscesses Sulfonamides were used in 47 per cent and penicillin in 11 per cent of cases Four patients believed to have a ruptured appendix were not operated on and recovered Complications directly attributable to operation were relatively few only five patients had cardiorespiratory complications. In 88 per cent of the cases of rupture and 35 per cent of the acute cases there was a delay of over 12 hours before operation 57 per cent of the deaths were in this group There were seven deaths in all

Although over all mortality was only 13 per cent better pre and postoperative care might have lowered it much more Complete alimentary rest must be maintained to combat peritonitis Therapy designed to prevent phebitis and emboli might have reduced the mortality by half Penicillin and streptomycin will favorably influence peritonitis.

Symptoms and signs are not as clearcut in this group as in the younger patients Gangrene occurs much more frequently probably because the initial circulation is poorer Early operation is indicated in most cases In no group of patients with ruptured appendicitis are supportive therapy, decompression and early ambulation more important

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(4) North Carolina M J 10 355 361 Jul 1949

Management of Appendical Abscesses is discussed by William P Montanus[6] (Springfield) A five year survey made in 1939 at Cincinnati General Hospital showed that the mortality for 129 patients with appendical abscesses treated surgically was about 10 per cent Lehman and Parker reported a rate of only 1 5 per cent in patients treated conservatively Surgical drainage may be unavoidable in some cases, but with adequate conservative treatment many appendical abscesses will undergo resolution without surgery

METHOD—After admission the patient is given no solid food by mouth but may be allowed fluids with safety If there is evidence of abdominal distention, continuous gastric or intestinal suction is started and adequate support provided by intravenous fluids, electrolytes, vitamins and proteins. In most instances small blood transfusions are given daily or on alternate days. Penicillin, 100,000 units, is given immediately and continued at three hour intervals. In addition, 250,000 units of streptomycin is administered with the same frequency If temperature and white blood cell count decrease and pain and tenderness are less marked after 12-24 hours, treatment is continued.

If at the end of the 12-24 hours the mass seems tense and pain and tenderness, with fever and white cell count, have not improved, surgical drainage is provided. Care should be taken to avoid contamination of the uninvolved portion of the peritoneal cavity A lateral McBurney type incision is recommended, and the peritoneum should be reflected to permit direct entry into the abscess cavity without transversing uninvolved peritoneum. The abscess site will frequently be posterolateral. If necessary, there should be no hesitancy in changing either the type or the location of the incision. The finger is a much more effective and safer instrument than the scissors or hemostat for draining the abscess.

After either conservative or surgical treatment, the patient must always be told that his appendix has not been removed. Although subsequently some appendixes may become obliterated, others again become inflamed. For this reason it is advisable to remove all of these diseased organs in about four months.

Patients over 60 have less ability to localize infection than younger persons, and delay of drainage over a long period should be approached with caution. Appendicitis is apparently a more serious disease in Negroes than in white persons. Lack of resistance may be manifest by a normal or below normal white blood cell count in the presence of perforated appendix. Dietary habits, occupation or economic circumstances may also influence the severity of

(6) Ohio State M. J 45:1073-1075 November 1949

appendical infections and the patient's ability to control them These factors should be considered in evaluating the need for conservative or surgical treatment

Carcinoid Tumors Re emphasis of Their Malignant Nature Carl M Pearson and Patrick J Fitzgerald[7] (Boston) reviewed 140 cases from the files of Mallory Institute of Pathology Of these 98 (70 per cent) occurred in the appendix and 42 (30 per cent) were nonappendical none of the former showed evidence of regional node involvement or distant metastasis whereas 16 (38 per cent) of the latter had metastasized Of carcinoid tumors discovered at autopsy 23 per cent also showed a second malignant noncarcinoid tumor Carcinoid tumors of the appendix usually occurred in the third decade and those of the small intestine in the fifth and sixth whereas those showing metastatic lesions usually occurred in the fifth decade or later Most nonappendical carcinoids occurred in the seventh and eighth decades, and the incidence of metastasis roughly paralleled that of the tumor

Appendical carcinoid tumors often produce obstruction of this organ or inflammatory reaction Signs and symptoms most commonly associated with small bowel carcinoids are those of slowly progressive or intermittent intestinal obstruction, but acute obstruction may develop Rectal carcinoid tumors cause bleeding and constipation in some cases Carcinoids with widespread metastasis have no signs and symptoms distinct from those of any widespread neoplastic process

In the appendix, carcinoid tumors usually occur at the distal end and when well developed, appear as bulbous swellings. Sections at this point usually show the lumen to be obliterated by a firm mass of pale yellow, gray or brown tumor The mucosa often and the muscularis usually are intact, although either may be replaced by tumor Carcinoids of extra appendical origin appear as one or more submucosal yellow or gray yellow nodules covered by intact mucosa. There may be partial intraluminal narrowing or extension through the bowel wall Kinking of the bowel by contiguous serosal growth of two adjacent loops may give

(7) Cancer 2:1005 1024 November 1949

rise to obstruction Primary lesions in this series were 0 1 3 cm. in diameter averaging about 1.7 cm.

In general, three cell types have been described round or polygonal, palisade and columnar They may form columns, nests, coils or amorphous masses Occasionally rosettes or pseudorosettes are formed The cytoplasm contains cholesterol and acidophilic granules which have argentaffin chromaffin and plumbophilic properties The stroma is composed of fibrous or hyaline connective tissue with a rich supply of fine capillaries and reticulum, nerve and elastic fibers. The authors regard all carcinoids as malignant, although usually slow growing

Treatment consists of resection of the primary tumor and as much of its metastatic growth as is feasible Such procedures are sometimes followed by many years of symptom free existence Use of radiation for these lesions has not been fully explored.

Acute Mesenteric Lymphadenitis. R W Postlethwait and Frank H. Campbell[8] report that of 1 604 patients admitted to Duke Hospital between July 1 1941 and Aug 1, 1946 because of an acute abdominal condition and treated by appendectomy 268 had acute mesenteric lymphadenitis. They reviewed the records of the 268 and compared them with those of 100 unselected patients with simple acute suppurative appendicitis treated during the same period, and made follow up studies of those with mesenteric lymphadenitis These patients included 99 males and 169 females 255 were white 11 Negro and 2 Indian.

Nonspecific mesenteric lymphadenitis is a symptom complex characterized by abdominal pain and tenderness. Many patients have a history of previous attacks of pain and about half have an upper respiratory tract infection Pain usually begins in the right lower quadrant, epigastrium or periumbilical region when it does not begin in the right lower quadrant it localizes there in 66 per cent of cases It is often paroxysmal with intervals of complete relief Tenderness is usually present in the right lower quadrant, but there are signs of peritoneal irritation in only about one third of the cases. Temperature and the white blood cell

(8) Arch. Surg 59:92 100 July 1949

count may or may not be increased Of 154 patients followed after operation, 17 5 per cent had recurrence of pain

In analysis of a large series of cases statistical differences in occurrence of symptoms and signs will be noted yet no single examination or group of observations is adequate to differentiate accurately between acute mesenteric lymphadenitis and acute appendicitis in the individual patient

Operation, with removal of the appendix is strongly advised Morbidity and mortality of appendectomy are so low that removal of 10 or more normal appendixes with the finding of mesenteric lymphadenitis, is more justifiable than permitting 1 appendix to perforate with resultant complications In the rare instance in which intercurrent disease or other factors contraindicate operation conservative treatment of suspected mesenteric lymphadenitis may be necessary Infrequently, symptoms and signs may suggest the disorder but be so mild that the patient can be kept under careful observation.

Nonspecific Mesenteric Adenitis Howard S Madigan and Robert J Coffey[9] (Georgetown Univ) review 184 cases Nonsurgical treatment was used in 99 patients, and 85 had exploration because of preoperative diagnosis of acute appendicitis Race distribution and sex incidence were not remarkable Patients were aged 5 months to 13 years (average 6 7 years)

There was a distinctly higher incidence of mesenteric adenitis during months in which infections of the upper respiratory tract are prevalent This favors the concept that mesenteric adenitis is commonly associated with such infection. In nonsurgical patients duration of symptoms averaged 52 hours before hospitalization in surgical patients, 38 hours The outstanding initial symptom was abdominal pain characteristically periumbilical or distributed throughout the entire lower abdomen. In one third, pain was localized in the right lower quadrant but was rarely so distinct as that with acute appendicitis Vomiting occurred in most patients On physical examination, patients did not appear seriously ill at admission. In 74 per cent of nonoperative patients inflammation of the tonsils or pharynx was noted,

(9) Arch Surg. 60 11 2 113 June 1950

but these occurred in only one third of those operated on. Demonstrable lymphadenopathy, usually involving the anterior or posterior cervical nodes, occurred in 80 per cent. Whether this was a result of upper respiratory tract infection or a manifestation of general lymphatic involvement is unknown. Diffuse abdominal tenderness was a constant sign. Laboratory data were not of great assistance in diagnosis

In 50 of the 85 surgical patients, the primary process was mesenteric adenitis There were no cases of suppurative or tuberculous mesenteric adenitis. In 22 patients there was gross evidence of subacute or chronic appendicitis in addition to enlargement of mesenteric nodes. In three cases of intussusception there was conspicuous mesenteric lymphadenopathy Two nonsurgical patients died one had acute splenitis and hepatomegaly and the other pneumonia. One patient with acute rheumatic heart disease died after surgery

If acute appendicitis cannot be ruled out in patients with mesenteric adenitis, laparotomy is indicated Removal of mesenteric nodes at operation has no therapeutic value

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COLON—RECTUM—ANUS

Routine Sigmoidoscopy Haskell M Wertheimer[1] reviewed 300 consecutive sigmoidoscopies done from Jan. 1 to July 31, 1947 All patients were males, aged 17 through 75 but most of them were aged 20-45 Over 90 per cent had been admitted with diagnosis of hemorrhoids The commonest complaints were rectal bleeding with or without local pain, diarrhea or alternating diarrhea and constipation.

Polypoid lesions were diagnosed in 15 patients (5 per cent) 9 had a single polyp and 6 had multiple polyps 12 had coexistent anorectal pathologic changes. Whenever possible the entire polyp including a portion of the base was removed for examination and the base fulgerized Diagnoses were benign polyp in seven polyp with hyperplastic

(1) U S. Navy M. Bull. 49 681-684 July-Aug 1949

changes in four, adenocarcinoma in three and inflammatory tissue in one Surgery was performed on five patients on four, resection of a portion of the sigmoid colon and end-to-end aseptic anastomosis and on the fifth an abdomino-perineal resection The fifth patient had an adenocarcinoma proved by biopsy and at operation was found to have lymphatic and liver metastases he died four months later with widespread metastatic carcinoma

Sigmoidoscopy is valuable in early detection of malignancy of the lower bowel and should be a part of the complete physical examination, particularly in patients with rectal bleeding and alteration of bowel function It should never be omitted before elective surgery for hemorrhoids or other anorectal pathology

Study of Intestinal Fixation, with Special Reference to Fixation of Ileocecal Part and Its Surgical Importance, was made by Hannes Sauramo and Juha Tapiovaara[2] in 52 fetuses 14 54 cm long and in 100 adults All material was macroscopically normal, and no previous operative procedures had been performed Intestinal fixation was normal in 64 per cent of fetuses and in 58 per cent of adults The ascending colon was not attached directly to the posterior abdominal wall but had a distinct mesentery of its own (hypofixation) in 7 per cent of fetuses and 3 per cent of adults. Fixation was by Jackson s membrane the membrane starting from parietal peritoneum on the right wall of the abdominal cavity and covering the right colic flexure, ascending colon, cecum terminal ileum, vermiform process and even the rectum in 6 per cent of fetuses and 11 per cent of adults Partial or complete fixation of the terminal ileum due to different peritoneal formations was noted in 19 per cent of fetuses and 29 per cent of adults Fixation of the entire terminal ileum was noted in 18 cases fixation with plica formations in 10 and fixation due to folds in 8 Hyperfixation of the colon was seen in 14 per cent of fetuses and 4 per cent of adults The cecum was mobile in 54 per cent of fetuses and fixed in the remainder, in adults it was mobile in 62 per cent and fixed in 38 per cent In 12 per cent of fetuses the cecum was immediately below the caudal

(2) Ann. chir et gynaec. Fenniae 39 32-52 1950

margin of the liver and in 2 per cent it was in the minor pelvis, among adults, the incidence was 2 per cent and 3 per cent respectively In fetuses the appendix was pelviocecal in 41 per cent, ileocecal, 23 per cent mediocecal, 17 per cent, laterocecal, 9 per cent, and subcecal 10 per cent In adults it was pelviocecal in 76 per cent ileocecal 4 per cent, mediocecal, 16 per cent, laterocecal 2 per cent, and subcecal, 2 per cent. Diverticulum ilei verum was found in 1 per cent of fetuses and in 1 per cent of adults

Mesenterioplasty in 119 patients with fixed terminal ileum without ileus resulted in a mortality of 5 per cent. In 262 cases of this condition with ileus, mortality was 39 per cent A mobile cecum was more significant clinically than Jackson's membrane Surgical resection in 47 patients with diverticulum ilei verum resulted in a mortality of 4 per cent but 5 of 22 patients with diverticulitis died post operatively In 30 patients in whom a diverticulum caused strangulation of the bowel, mortality was 30 per cent.

New Concept of Cause of Hirschsprung's Disease or Congenital Megacolon, with New Method of Treatment by Surgery, is presented by Alexander H Bill, Jr [3] (Univ of Washington), who also reports successful treatment of five patients. Other investigators have shown that congenital megacolon is due to low grade obstruction resulting from an area of narrowed bowel in the upper rectum and lower sigmoid which lacks effective peristalsis, thereby slowing the fecal stream Pathologic examination shows that the myenteric plexus is deficient in the narrowed bowel.

Diagnosis of congenital megacolon may be made by oblique x ray views with a barium enema, a small amount of barium mixture being allowed to run in slowly Satisfactory treatment is abdominoperineal excision of the area of narrow bowel with preservation of the anal sphincter

The pathologic rectosigmoid segment is isolated in the following manner

Technic —The sigmoid is divided just above the pelvic brim and the rectosigmoid and rectum in the pelvis are dissected free. This lower portion of bowel is then everted through the anus and cut off. The end of the sigmoid is drawn down through the pelvis and out through the anus. Under full vision a two layer anastomosis is per

(3) Northwest Med. 49 341-344 May 1950

formed between the end of the sigmoid and the remaining 2 in. stump of rectum The completed anastomosis is then reduced into the pelvis and the abdomen closed

Congenital Megacolon Report of Three Cases of 'Obstructive" Type Treated by Resection of Dilated Segment in Contrast to Resection of Distal Narrowed Segment, is made by Joseph A Ritter Herbert R Hawthorne and Harry V Metzger[4] (Univ of Pennsylvania) Idiopathic congenital megacolon is characterized by simple dilatation of the terminal large intestine without obstructive narrowing of the contiguous distal segment A functioning bowel may be maintained by conservative methods, surgery is rarely indicated The chief feature of the obstructive type is a dysfunctioning segment of large bowel normal in caliber or narrowed, and situated distal to the dilated segment. Permanent relief usually requires definitive surgery The cause of the narrowed segment is agenesis of the intramural, myenteric and submucous plexuses resulting in an obstructive lesion on a neurogenic basis. Although many surgical procedures have been used recently authors have reported success from abdominal resection of the narrow distal segment and a portion of the contiguous dilated sigmoid, and a "pull through" of the proximal dilated segment with preservation of the anal sphincter

In these three patients the dilated segment was resected after which the distal narrowed segment returned to nearly normal caliber distensibility and propulsion There was no evidence of recurrence 15 months postoperatively These results suggest that the preferential choice of resection of the neurogenically obstructive segment may be on an equivocal physiologic basis

[This seems to be an amazing procedure. It i ordinarily supposed that the dilatation of the colon above the constricted area is due to the pressure built up in that part of the colon by its efforts to force feces past the constriction. As additional evidence of the validity of that conclusion is the fact that the dilated part of the colon shows great hypertrophy of its muscle coats I can see no logic in removing the hypertrophied portion, which is the active part of the colon.—Ed.]

Anorectal Anomalies Statistical Study of 165 Cases with Special Reference to "Distal Loop Trouble" was made by Charles W Mayo (Mayo Clinic) and Roberta G Rice[5] (Mayo

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(4) Pediatrics 5 791 798 May 1950
(5) Surgery 2 485-494 April 1950

margin of the liver, and in 2 per cent it was in the minor pelvis, among adults, the incidence was 2 per cent and 3 per cent respectively In fetuses the appendix was pelviocecal in 41 per cent, ileocecal, 23 per cent, mediocecal, 17 per cent, laterocecal, 9 per cent, and subcecal, 10 per cent In adults it was pelviocecal in 76 per cent ileocecal, 4 per cent, mediocecal, 16 per cent, laterocecal 2 per cent and subcecal, 2 per cent. Diverticulum ilei verum was found in 1 per cent of fetuses and in 1 per cent of adults.

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(3) Northwest Med. 49 341 344 May 1950

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(4) Pediatrics 5 791 798 May 1950

(5) Surgery 27 485-494 April 1950

Found) The four patients with type I anomaly had either anal or rectal stenosis. All 62 patients with type II anomaly had imperforate anus, the obstruction being due to a membrane Type III malformation, which was seen in 95 patients, comprised imperforate anus with the rectal pouch ending blindly some distance above. In the four patients with type IV anomaly the anus and sphincter and some portion of the lower rectum were normal, but the upper portion of the rectum ended blindly and was separated by a variable distance from the lower pouch.

Diagnosis of imperforate anus is usually made by the nurse, who tries to take the patient's rectal temperature or notes meconium with the urine

There were 85 males and 80 females About 91 per cent of males and 98 per cent of females had type II or III anomaly Some associated anomaly was found in 51.8 per cent of males and 86 3 per cent of females

The method of treatment depended on type of anomaly and age of the patient. If there was only a thin membrane between the proctodeum and rectum, the procedure of choice was to cut or puncture the membrane and observe the patient carefully, using repeated dilatations to avoid rectal and anal strictures When the anus was absent but depression or dimple present as well as rectal sphincters and when bulging of the blind end of the rectum could be seen, the usual treatment was proctoplasty bringing the rectal mucosal edges to the anal skin margin. When the rectum was high colostomy was performed immediately or perineal exploration was attempted in an effort to find the end of the rectum bring it down and suture rectal mucosa to the anal skin edges. In a newborn boy with a high rectum perineal exploration should be postponed, especially when there is evidence of rectovesical or rectourethral fistula In these patients colostomy should be performed as soon as possible, with care to separate the proximal and distal barrels of the stoma In a newborn girl with a rectovaginal fistula, repeated dilatations of the fistula usually suffice until the child is old enough to allow a successful rectovaginal plastic procedure The latter is recommended because of the relatively high incidence of urinary infections when the condition is not cared for *Congenital stricture of*

the rectum and anus usually occurred 2-4 cm from the anus up to the level of the mucocutaneous junction.

Colostomy was performed in 39 4 per cent of the patients About one third had distal loop trouble such as impacted feces, barium concretion, distal barrel prolapse, distal barrel retraction or dribbling of urine from the distal loop In the whole series 50.3 per cent had good or satisfactory therapeutic results and 40 6 per cent fair or poor results There was a hospital mortality rate of 9 1 per cent but four of the deaths were directly due to associated congenital anomalies

Torsion and Other Affections of Appendices Epiploicae. Cecil Wakeley and Peter Childs[6] (King's College) report eight cases Appendices epiploicae are found along the large bowel except the rectum They are most numerous in the transverse and sigmoid colons Each is composed of a peritoneal sac containing fat with a single artery and vein entering and leaving at the attachment to the bowel wall. Their size is variable although they tend to be larger in obese persons Their function is uncertain, but they may serve as a storehouse for fat or have a protective and localizing action similar to that of the greater omentum in the presence of infection.

The surgical significance of appendices epiploicae lies in a liability to torsion or infarction. Chronic torsion may give rise to fat necrosis fat saponification, fibrosis and perhaps even calcification In more acute cases there may be organization with adhesion to other viscera and formation of a band around which a loop of bowel may become twisted and obstructed

The sexes are equally affected, but the condition occurs most commonly between ages 20 and 60 Abdominal pain is the chief complaint and may be sudden or gradual in onset. Its site varies with the site of the affected appendage Appendices epiploicae of the sigmoid colon and cecum are the commonest sites of torsion and infarction Usually the patient is not acutely ill Nausea and vomiting are usually absent There may be a slight fever and in more severe cases polymorphonuclear cytosis Abdominal examination

(6) Lancet 2 594 595 Oct. 1 1949

reveals signs such as decided local guarding or rebound tenderness referable to the strangulated appendage site. *An appendix epiploica which undergoes torsion in a hernial* sac will give signs of a strangulated hernia There are no pathognomonic features on which a diagnosis can be made preoperatively

Treatment is excision of the strangulated appendix epiploica.

Primary Inflammatory and Ischemic Disease of Appendices Epiploicae in one patient is reported by Thomas Wilensky[7] (Lansing Mich.) The disorder is significant because its symptomatology is clinically indistinguishable from that *of other intra-abdominal lesions. Infarction or gangrene* may result from a strangulated blood supply produced by torsion of the pedicle or from degenerative vascular processes resulting from trauma or engorgement with thrombosis. Since appendical veins are longer than corresponding arteries, they may twist around the arteries, causing gangrene Mesenteric venous engorgement during digestion may be the precipitating factor Infection of the appendage may be directly related to the presence of lymph nodes in the appendage Diagnosis of epiploic appendicitis may be made on the basis of an unrecognized, underlying acutely inflamed, pathogen laden intestinal diverticulum. Needless to say cutting across such a structure is a serious technical error

The disease occurs most often among well nourished and obese persons. There is no characteristic symptom complex, but the most constant feature is sharp or cramp-*like* abdominal pain, which varies in location according to the site of the diseased appendage Unmistakable local tenderness is the most common sign, and abdominal rigidity is usually absent. Hyperesthesia of the skin has sometimes been noted.

There is no agreement concerning the physiologic usefulness of these appendages. They may act as miniature omenta performing a defensive role, or they may be merely protective fat pockets for redundant intestinal vessels when the intestinal wall is collapsed.

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(7) J Michigan M. Soc. 49 458-460 April, 1950

Sigmoidovesical Fistulas Resulting from Diverticulitis of Sigmoid Colon. L. Henning Mayfield and John M. Waugh[8] present data on 32 cases in which a segment of colon was removed surgically at Mayo Clinic. The longest segment excised measured 25 cm. and the shortest 7 cm. (average 12.4 cm.). The segments presented many diverticula, and their walls were involved in a chronic extramucosal proliferative inflammatory process; commonly areas of necrosis, abscess formation and perforation were seen. The youngest patient was 27 and the oldest 76 (average 54 years); there were 28 (87.5 per cent) men and 4 (12.5 per cent) women. Women are less likely than men to have sigmoidovesical fistulas because of the protection afforded the bladder by the female pelvic viscera.

Symptoms included abdominal pain, constipation, diarrhea, pneumaturia, frequency of urination, dysuria, passage of feces in the urine, hematuria, passage of urine by rectum, and chills and fever. Either intestinal or urinary tract symptoms may predominate. The patients had had symptoms of diverticulitis for an average of about 3½ years and urinary tract symptoms for an average of about 3½ months when the fistulas developed; most fistulas developed spontaneously.

A mass could be palpated through the abdominal wall in nine cases; it was revealed by rectal examination in five and by bimanual pelvic examination in one. Preoperatively, proctosigmoidoscopy was done in 28 cases, roentgen examination of the colon in 29 and cystoscopy in 25. In 12 cases the fistulous opening into the bladder was seen, and in 12 others there were areas with evidence of cystitis, dimpling and projections of granulation tissue—findings compatible with the presence of a sigmoidovesical fistula. In one case a healed fistulous opening was observed. The posterior wall to the left of the midline was most often involved. Cystoscopy and roentgenography were the most important aids in diagnosis. There was no infection of the upper urinary tract in any case.

Some type of resection of the colon was done at the Clinic in each of the cases. Spontaneous closure of the fistula

(8) Ann. Surg. 130: 186-199, August, 1949.

is rare Any type of surgical treatment less radical than excision of the diseased segment of colon and closure of the vesical opening usually fails In most instances it is advisable to provide proximal drainage by temporary transverse colostomy for six months before resection. Of the present group, 8 patients died postoperatively and 28 were cured of their fistulas

Surgical Treatment of Ulcerative Colitis Bentley P Colcock[9] (Lahey Clinic) states that treatment of this disease is primarily medical, but at least 25 per cent of patients require surgery for preservation of life, relief of chronic invalidism, or one of the frequent complications of the disorder From 1927 to January 1949, 263 patients with ulcerative colitis were operated on at the Clinic. Ileostomy was performed on 216 and partial colectomy in 59, and 148 had a complete colectomy in addition to ileostomy Indications for surgery are acute fulminating ulcerative colitis, hemorrhage, perforation, infectious arthritis, obstruction, malignant degeneration and intractability

Appendicostomy cecostomy and colostomy are of little value in treatment The surgical procedures at present used are ileostomy and subtotal or total colectomy In the small group of patients in whom the disease is limited to the right side, subtotal colectomy with restoration of intestinal continuity may be used, but the poorest results have occurred in this group because it is difficult to determine the exact point in the colon where the disease begins and ends. Most patients in whom surgery is indicated require ileostomy This is followed by two-stage total colectomy and abdominoperineal resection, depending on the extent of the disease, persistence of symptoms such as chronic anemia, malnutrition and infectious arthritis, or development of a complication such as perforation or cancer

In the last few years the first stage of colectomy removal of the colon to the midtransverse or mid-descending segment, has occasionally been carried out at the same time the ileostomy is established. This combined procedure should be limited to patients in the chronic cicatricial stage In a few patients the ileostomy can be closed and intestinal con

(9) New England J Med. 242:320-323 Mar 2 1950

tinuity re-established. The following criteria for closure have been used: complete remission of symptoms for a year or more, normal rectum and rectosigmoid on sigmoidoscopic examination and demonstration of an adequate lumen in the remainder of the colon with a barium enema. With these criteria it has been possible to close the ileostomy in only 10 per cent and in half of these reactivation of the disease made re-establishment of the ileostomy necessary.

The mortality in all patients operated on before 1947 was 22.3 per cent, that following ileostomy was 18 per cent. In many of these cases surgery was used as a last resort, and some patients were already moribund when operated on. In 97 operations during 1947 and 1948 mortality was 4.1 per cent, mortality for ileostomy alone was 5.6 per cent and operative mortality 2.6 per cent.

Complications of Ulcerative Colitis in 129 patients are reported by J. M. Rice-Oxley and Sidney Truelove[1] (Oxford Univ.). Cutaneous lesions were the commonest, occurring in 9.3 per cent. In five patients they were minor, transient and largely overshadowed by exacerbations of colitis, but in seven they comprised major episodes, being accompanied by arthritis in five. Erythema nodosum occurred in four patients, three of whom had arthritis. It was probably an allergic response to toxins in the bowel. In one patient generalized exfoliative erythema was attributed to gross vitamin deficiency; the rash probably was pellagrous. Diarrhea, arthritis and purpura were associated in one patient, but diarrhea preceded onset of the other symptoms by 1½ years. Subsequently they occurred together on a seasonal basis, suggesting an allergic factor.

Carcinoma of the colon or rectum was noted in four patients whose average age was 37. Other complications included rectal stricture in 7 of the 129 patients, fecal fistula in 5, buccal ulcerations in 4, conjunctivitis in 2 and rectal prolapse, biliary cirrhosis or adrenal hemorrhage each in 1. Three of four patients with perforation died. Cirrhosis may have resulted from nutritional deficiency in one patient. Adrenal damage may contribute to the dehydration and rapid weight loss often seen in severe fulminating

(1) Lancet 1:607-611, Apr. 1, 1950.

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(9) New England J Med. 242 220-223 Mar 2 1950.

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(1) Lancet 1:607-611 Apr 1 1950

ulcerative colitis. For these patients, cortical extract might be a useful adjunct to treatment

Carcinoma of Colon Complicating Chronic Ulcerative Colitis occurred in 12 of 316 patients observed by William J Gleckler and Charles H Brown[2] (Cleveland Clinic) This incidence may be low, for follow up examinations over a long period are difficult to maintain in this group In three patients carcinoma was discovered during operation for other indications. Average age of onset of ulcerative colitis was 28 Carcinoma was found at an average age of 44.3 It is suggested that carcinoma of the colon may occur earlier in a person who has ulcerative colitis than in one who does not have it.

Malignant lesions occurred in all portions of the large intestine Pre-existing polyposis was present in 43 per cent of the patients. Chronic inflammation and irritation resulting in hyperplasia and proliferation may finally lead to carcinoma The stage of polyposis may or may not intervene between hyperplasia and frank carcinoma.

In some patients an exacerbation of symptoms of ulcerative colitis, appearance of abdominal mass and abdominal and rectal pain were warning complaints. It is usually impossible to distinguish symptoms due to carcinoma from those of an exacerbation of colitis.

Persons with ulcerative colitis should have regular follow up examinations consisting of such procedures as proctoscopy and barium enema Subsequent neoplasms of the colon in these patients support the hypothesis that once an ileostomy is necessary total colectomy should be considered.

Complications of Ileostomy Frank H. Lahey[3] states that ileostomy for ulcerative colitis no longer carries a high mortality Performance of the operation at a better stage of the disease is largely responsible In an early stage a single barreled end type of ileostomy can be performed and mortality will be low The double barreled type is undesirable but is the only type justifiable for patients in emergency states. It should almost never be used for a permanent ileostomy but may be used in the rare cases in which the fecal stream is to be restored if the disease process quiets

(2) Gastroenterology 14 455-464, April, 1950
(3) S. Clin North America 30 892 899 June 1950

down sufficiently. The single barreled ileostomy, because of the ease with which the Koenig-Rutzen bag can be applied, is the only desirable type for permanent ileostomy. Further experience indicates that once ileostomy is established the colon and rectum, if they are entirely involved in the ulcerative process, should be removed. When such colons are put to rest they become cicatrized so that restoration of the fecal stream will not be feasible. If the fecal stream is again re-established there may be such exacerbation of the disease that re-establishment of an ileostomy will be necessary. Interference with general nutrition, occasional joint involvement and tendency to malignancy are other reasons for colectomy. With removal of the colon the character of the ileal discharge will distinctly thicken.

One of the most important features of an ileostomy is its location. It must be placed on the abdominal wall so that the collar of the ileostomy bag (Figs. 158-160) will come into perfect contact with the skin. The success of an ileostomy bag depends on how perfectly it can be cemented about the protruding end of the ileostomy. Since many patients with ulcerative colitis will have lost considerable weight, their scaphoid abdomens make it difficult to finding locations where contact will be ideal. The umbilicus, ribs in the right upper quadrant, pubis, and the anterior superior spine should be avoided. If possible the ileostomy should be introduced through a stab wound in the wall about half way between umbilicus and pubis. It should be placed in a segment of skin where no other incision exists. When the end of the ileum is implanted at the bottom of a right rectus incision of adequate length to expose the ileum and divide it, the patient's later gain in weight may cause the ileum to lie in a deep valley created by the scar of the incision.

Prolapse of ileostomy can be prevented if the divided mesentery of the ileum is sutured to the parietal peritoneum directly beneath the ileostomy opening for 3-4 in. Retraction of the ileostomy into the abdomen will cause no difficulty if sufficient ileum is allowed to protrude. All irritation and ulceration of the skin about the ileostomy may be prevented with good fitting bags. Bags can be applied soon after ileostomy is established but may have to be refitted as the diameter of the ileostomy decreases with age.

Occurrence of a fistula into the implanted ileum at the level of the skin can be treated successfully only by establishment of a new ileostomy. These fistulas usually result

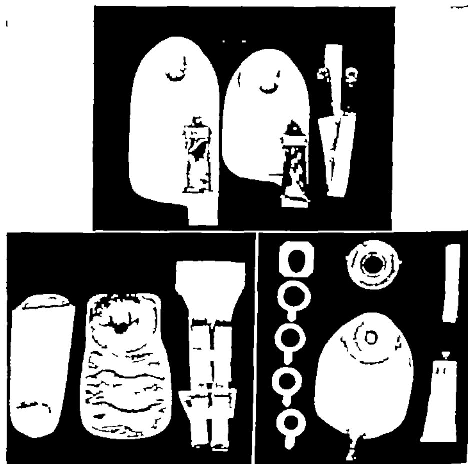


Fig. 158 (top) —Day and night Koenig Rutzen bags for double-barreled ileostomy. Belt attaches to two concealed hooks. Cement is used to seal bag to skin.
Fig. 159 (bottom left) —Traveller bag for temporary application by contact to ileostomy until opening has shrunk to proper size for permanent Rutzen or Torbot bag. Bag is not cemented to skin and is not watertight.
Fig. 160 (bottom right) —Torbot bag—recent development by patient on whom ileostomy and colectomy were done. Note on left various-sized apertures to measure ileostomy for purpose of ordering bag with aperture of proper size. In center are detached plastic disk and assembled disk and bag. To right are belt and tube of cement. While belt is generally used for supporting both Rutzen and Torbot bags, they will remain attached by cement alone.
(Courtesy of Lahey F. H.: S. Clin. North America 30 893-899, June 1950.)

from suturing the fascia too close to the ileum. The ileum can be implanted quite loosely within the abdominal wall, without suturing skin and fascia about it, and wrapped in boric ointment or dry gauze. It will soon become adherent

and fixed to the skin subcutaneous fat, muscle and peritoneum

Immediate drainage should be established at operation by passing a catheter into the ileum The abdominal wall should be protected by towels wrapped closely about the ileostomy the ileostomy held upright and the Ochsner clamp removed while the catheter is passed The ileum should be tied about the catheter wrapped in gauze and a sufficient amount should project on the abdominal wall Daily inspection of both ileostomies and colostomies is important since marginal vessels may be torn by vomiting and coughing with destruction of the blood supply and resulting gangrene of the protruding bowel If a black ileum is discovered within four days, the wound may be reopened and fresh bowel pulled out thus preventing an undesirable complication The danger of fluid and electrolyte loss in ileostomies must be realized and appropriate replacement carried out Liquid discharges can best be controlled by administration of bismuth or kaolin and a low residue bland diet Cramplike pains beneath the ileostomy within two or three weeks after operation do not indicate obstruction and usually become better as the edema disappears

Sterilization of Defunctionalized Loops of Colon in Preparation for Anastomosis with Other Viscera Method of Study and Appropriate Selection of Antibacterial Agents are outlined by Chester W Howe[4] (Boston Univ) who used a combination of antibiotic and chemotherapeutic agents in two patients to prepare the colon for anastomosis with other viscera In full thickness segments of the colon taken at operation and cultured anaerobically and aerobically, the usual profuse mixed intestinal flora which had been prominent in the pretreatment cultures were completely absent

METHOD—(1) Because of the rapid development of resistance of certain organisms to streptomycin the drug is reserved for later use should infection develop (2) After the colostomy is open cultures are made from the transverse colon These are tested for sensitivity against available antibiotics suitable for oral administration. (3) Colostomy and rectal enemas are given and magnesium sulfate instillation is done until the bowel is clean The antibiotic agent is then used with sulfathalidine® for instillations into the bowel thus

(4) J Lab & Clin Med 34 1469-1475 November 1949

combination should be effective against both gram negative and gram positive organisms. Sulfathalidine® is preferable to sulfasuxidine® because of its greater bacteriostatic activities. (4) The midcolon is cultured three days before operation, and sensitivities to various antibiotics of the constituents of the flora as now altered by therapy are determined. (5) Sulfathalidine® is omitted two days before operation and sulfasuxidine® substituted. A definite penicillin sulfathalidine® antagonism has been shown to affect certain gram-negative organisms. Penicillin is administered intramuscularly, as aerosol and in the form of lozenges. (6) The daily doses of sulfathalidine® or sulfasuxidine® are crushed and suspended in saline in which the antibiotic is dissolved. This may then be instilled into colostomies, gastrostomy or rectum in equally divided doses five times daily The volume of each instillation should be 100-200 cc. The day before operation instillations are reduced to a volume of 10 cc. so that the bowel will be dry for the procedure. Oral medications are given in equally divided doses on the same schedule.

Since infection did not develop postoperatively in either patient, the information gained from the preoperative cultures and sensitivity studies was not utilized. However, such advance information makes possible a more rapid and intelligent choice of antibacterial agent This type of bowel preparation may reduce the risk of infection and extend the scope of surgical usefulness of the colon.

Technics of Abdominotransanal Resection of Rectum by Invagination without Preliminary Anus and with Systematic Lowering of Transverse Colon. André Toupet[5] (Paris) uses two special instruments for this procedure a bougie to invaginate the rectum and an articulated metal ring The bougie consists of a curved hollow tube, 15 mm. in diameter and 25 cm. long with one conical extremity, the base of which is 30 mm. in diameter, the other extremity is provided with an oblong pulling piece and a screw threaded stopper to allow evacuation of gases. The metal ring has an exterior diameter of 35 mm. and an interior diameter of 27 mm., with an automatic locking piece (Fig 161)

TECHNIC.—The invagination bougie is introduced into the rectum before operation is begun. In the first step which is abdominal the rectum is liberated down to the levator ani muscles, a ligature placed around the rectum 4-5 cm. above the levators and tightened on the bougie, and the ring placed over the ligature and closed (Fig 162) The lowering ligatures are put in place and the transverse colon mobilized. To allow lowering of the transverse colon, the inferior mesenteric artery (Fig 163) is cut at its origin above the left colic

(5) J de chir 66:37-58 January 1950

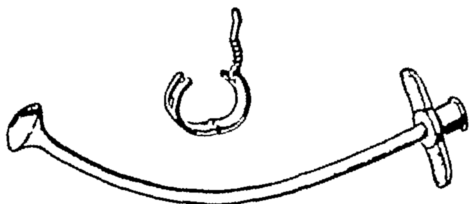


Fig. 161.—Bougie and metal ring which facilitate resection of rectum. (Courtesy of Toupet, A.: J. de chir. 60:37–58, January 1950.)



Fig. 162.—After liberating the rectum, the metal ring is placed over the ligature and closed. (Courtesy of Toupet, A.: J. de chir. 60:37–58, January 1950.)

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(5) J de chir 66 27-38 January 1950.

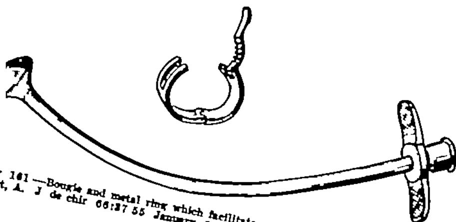


Fig 161 —Bougie and metal ring which facilitate resection of rectum. (Courtesy of Toupet, A. J de chir 66:37 55 January 1950)

Fig 162.—After liberating the rectum, the metal ring is placed over the ligature and closed. (Courtesy of Toupet, A. J de chir 66 37 55 January 1950)

artery and the inferior mesenteric vein is cut as high as possible at 2-3 cm. from the lower border of the pancreas.

The second step is perineal and consists of invagination of the anorectal canal with section and lowering of the rectum and colon (Fig 164 1) An assistant exerts gentle and gradual traction on the bougie while the surgeon pushes on the head of the bougie not on the tumor, to aid invagination The metal ring covered by the ano-

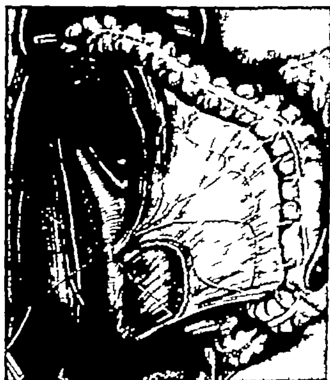


Fig 163 —To allow lowering of the transverse colon, the inferior mesenteric artery is cut at its origin. (Courtesy of Toupet A. J de chir 66:37 55 January 1950.)

rectal canal is exteriorized 5-6 cm., depending on the level at which the ligature was placed on the rectum and on the depth of the liberation of the rectum. In this manner a prolapse is formed which is composed of the external layer consisting of the low portion of the anal canal the middle layer of the high portion of the canal and the internal layer of the rectum itself. The assistant cleans the prolapse and culdesac formed by reflection of the external and middle layers with ether and incises the rectum in its entire circumference on the metal ring (section of the middle layer) Then the portion of the rectum above the ligature and the tumor come down in one block. The assistant continues to pull the colon outside the anus until the transverse colon is placed vertically on the left side of the

lumbar spine, he tells the surgeon what distance separate the anus from the ligature of the lower mesenteric artery (usually over 20 cm.)

The third step is abdominal and consists of peritonization and closure of the abdomen The fourth step is perineal and consists of anastomosis (Figs 164 *B* and 165) Of the five possible procedures



Fig. 164 —Invagination of anorectal canal (insert *A*) with section and lowering of rectum and colon. Anastomosis by contact (insert *B*) (Courtesy of Toupet A. J de chir 66 37 56 January 1950)

which may be used for this purpose, Toupet prefers anastomosis by contact with secondary suture.

Results are excellent when the colon has remained perfectly vascularized. In 10 patients operated on, the lowered loop remained well vascularized each time and spurted blood when the exteriorized segment was resected In eight patients the result was excellent, with complete cure in two to three weeks. In one patient a technical error resulted in a small vaginal fistula, but it healed in two months. The

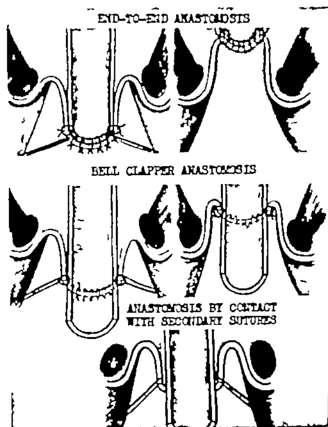


Fig. 165.—Procedure used for anastomosis. (Courtesy of Toupet, A. J de chir 66 37 55 January 1950)

one death was due to embolism on the eighth postoperative day in a woman, aged 72, in whom the operation had been successful.

[A natural query is Does the method permit the removal of an adequate amount of perirectal tissue?—Ed.]

Ileocolorectoplasty João B de Resende Alves[6] (Univ of Minas Gerais) performed this operation successfully on one patient and recommends it for cases in which it is impossible to bring the colon down to the preserved rectal sphincter

TECHNIC.—The first stage of the operation consists of colorectal resection with conservation of the sphincter At the second stage, the terminal loop of the ileum 10-15 cm. from the cecum is examined through a left paramedian incision and its longest principal vessels are identified these are left undisturbed so that they may supply

(6) Rev brasil de cir 19 9 18 January 1950

the loop of small intestine to be isolated. The position and continuity of the marginal vessels are verified, and the other vessels which are not needed for nutrition of the loop are ligated The long vessels are then ligated at their two extremities close to the point of section of the small intestine. The intestine is cut, and its ends are closed. The suture of the distal end of isolated loop is caught up with a hemostat.

Laterolateral, ileoileal anastomosis is performed to restore passage in the small intestine. Isoperistaltic, terminolateral anastomosis of the isolated loop with the culdesac of the colic stump is performed. A passage is made through the sphincteric portion remaining from the colorectal resection and a forceps is inserted which bulges into the peritoneal cavity The peritoneum is incised, and adhesions are sectioned. The suture left at the distal end of the isolated loop is caught by the forceps and the loop gently pushed through the peritoneal opening, care being taken not to pull on or rupture its nutritive vessels and not to twist it. When the loop is in the anal region, its antimesenteric border is caught by atraumatic forceps and its sutured extremity is turned into the abdominal cavity The purpose of this step is to relax any tension on the marginal vessels and allow making a large incision in the antimesenteric border of the loop, so that, even with retraction of the new anus, there will not be any stenosis. The abdominal wall is closed, and the edges of the ileal incision are sutured to the anal mucosa.

Operative Treatment of Recurrent Rectal Prolapse by Sarafoff's Method. P J Schuckert[7] (Berlin) reports

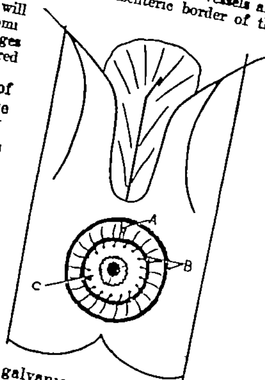


Fig. 166.—*A* skin flap is removed *B* wound edges *C* dissection of soft tissues around sphincter (Courtesy of Schuckert, P J Zentralbl. f. Chir 72 1193-1194 1947)

two cases of recurrent rectal prolapse following Whitehead operations for hemorrhoids Both patients were incontinent after this procedure and were not improved by galvanic current or other measures. Instead of more extensive plastic operation on the

(7) Zentralbl. f. Chir 72 1193 1194 1947

rectum, Schuckert used the method described by Sarafoff. Both patients were free from symptoms 18 months later

TECHNIC.—A broad circular incision is made 1 cm. from the anus which has previously been closed with a silk retraction suture. The incision is deepened to the fat, bleeding is controlled, and a second incision 1 cm. lateral to the first is then carried down to fatty tissue These two wounds encircling the rectum leave a bridge of tissue between them (Fig 160) This bridge is undermined and removed, leaving a deep wound which may reach 4 cm. in width as the tissues retract on either side When the retraction suture is drawn up, the tissues surrounding the anus are undermined as close to the sphincter as possible. Cutting the raphe perinei and anococcygeal ligament is the final step When the anal suture is removed and the wound dry the entire anal region will retract upward. A thick drain coated with petrolatum is placed in the rectum and anchored with two catgut sutures and the circular wound is packed with gauze strips. The packing is renewed in nine days. When healed, the scar makes a rigid ring encircling the anus which replaces or reinforces the sphincter

Rectal Prolapse. T Edward Wilson[8] (Sydney) states that in children rectal prolapse occurs with equal frequency in the sexes, but in adults it is nearly 10 times more common in women than in men. The higher frequency in women is probably due more to the construction of the pelvic floor and the existence of a mobile rectum than to the trauma of childbirth Initiating factors may be a congenital defect in the structure of the pelvic musculature, a deeper Douglas pouch general debility or weakness of all tissues or a relaxed sphincter from neurologic causes. Before operation it should be determined whether prolapse is partial or complete and, if complete whether the anterior part contains peritoneum bowel or vagina. Sigmoidoscopy is imperative before treatment for despite the presence of prolapse there may be an accompanying rectal carcinoma The causes of straining should be sought for and, if found, given attention. Treatment is delayed if the prolapsed portion of the bowel is inflamed or if its vessels are thrombosed. Rectal prolapse is treated and cured before a coexisting cystocele, uterine prolapse or rectocele Regardless of the treatment instituted for prolapse attempts should be made to improve the tone of anal sphincter muscles by exercises and perhaps by electric stimulation. Bowel movements are kept soft

(8) M. J Australia 1 461-465 Apr 8 1950

with a simple laxative if necessary, but limited to one daily. Periodic follow up is necessary so that recurrence may be detected and treated in the early stages.

In children rectal prolapse may clear spontaneously. Predisposing causes such as phimosis, atresia of the external urinary meatus vesical calculus chronic bronchitis, constipation or diarrhea should be treated before other methods are utilized Injection treatment gives satisfactory results with practically no complications. Under general anesthesia 3 ml. of a 5 per cent solution of phenol in oil is injected into the submucosa at three or four sites as high up the bowel as possible Similar rings of injections are then made at a lower level in the bowel. If there is recurrence, injections may be repeated, and at the same time 1 2 ml absolute alcohol is injected into the perirectal tissues on each side of the rectum

For adults with partial prolapse a ligature operation is best. The procedure resembles hemorrhoidectomy and usually consists of ligation and excision of three areas of prolapsed mucosa Because of low mortality and recurrence rates and infrequency of complications, rectosigmoidectomy is the operation of choice in complete rectal prolapse It consists of removal through the anus of the prolapsed portion of the bowel and any redundant sigmoid The peritoneal fold anteriorly is also excised after which the peritoneum is closed at a higher level. Division of the outer portion of the bowel is performed at, not above, the anorectal ring Bowel movements are discouraged for one week, after which mineral oil or glycerin suppositories may be given. Straining should be avoided. Digital examination of the rectum is performed every few days postoperatively to insure that impaction of feces is not occurring Complications are rarely dangerous but pyrexia, tachycardia abdominal distention pelvic peritonitis, separation of the suture line or narrowing of the bowel lumen should be anticipated Recurrence may be treated by phenol injection, ligation or a second rectosigmoidectomy Recurrence may also be treated by Moschcowitz s procedure which consists of elevation of the pelvic floor by a series of purse-string sutures inserted in the pararectal rectovesical or rectouterine fossae of the peritoneum These silk or linen sutures obliterate any her

nial sac in the anterior part of the prolapsed tissue and support and elevate the rectum During operation, the rectum is held up straight so that the lumen is not obstructed by the sutures Sutures are tied firmly so that no peritoneal pouch remains in which a loop of bowel might become incarcerated If recurrence follows Moschcowitz's operation, the operation may be repeated if indicated For adults with complete prolapse who cannot co-operate in exercises to improve poor anal sphincter tone and whose general condition is poor, Thiersch's operation is recommended It consists of narrowing the lumen of the anal canal by a silver wire or other ligature placed in the perianal space

Surgical Treatment of Familial Polyposis of Colon. Earl J Boehme[9] (Los Angeles) reports seven cases, six in one family in which history of polyposis has been traced over 136 years with about 40 per cent of the first four generations affected (Fig 167) Treatment consisted of preliminary preparation of the rectum and rectosigmoid by fulguration of polyps and a one stage resection of the terminal ileum and colon to the rectosigmoid with primary end to-end anastomosis of the ileum to the rectosigmoid The length of the segment of terminal colon and rectum that may be allowed to remain is nearly equal to that of the ordinary 20 cm. proctoscope The suction-cautery technic of fulguration is described

TECHNIC.—A long hollow metal bronchoscopic suction tube is covered with rubber tubing except for 1 mm. at the suction end. At the proximal curved end is attached the fulgurating current and a rubber suction tube. Use of suction with cautery is a great improvement over the usual method with a metal ball point held against the polyp for the ball point tends to roll out from under its pressure and may destroy adjacent mucosa and even perforate the bowel wall. With suction smoke is automatically removed during fulguration. What is more important, the hollow tip placed against the polyp will pick it up by suction and hold it away from the bowel wall while it is fulgurated (Fig 168) Tiny polyps are sucked into the end of the tube and can be destroyed while under tension so as to stretch the pedicle even the most sessile-appearing tumor has a demonstrable pedicle when stretched. When the polyp is large, the suction tip is placed against the neck, the suction turned on to fix the tumor at that point and the cautery used to destroy the blood supply to the rest of the tumor

(9) Am. Surg. 131 519-533 April, 1950

HEREDOFAMILIAL POLYPOSIS

Fig. 187 —Family history of polyposis, one of the longest ever traced (130 years) (Courtesy of Boehme E. J Am. Surg 131 519-533 April, 1950)

With this method *as many* as 300 *polyps* have been destroyed at one sitting The patients do not experience the pain which accompanies the ball point method of cauterization.

Ages of the patients varied from 12 to 48 years, with an average of 29 years. The average number of polyps was 211

in the rectum and lower sigmoid and 4,840 in the colon. There were no deaths, and no patient has more than three stools in 24 hours Rectal segments are free from polyps

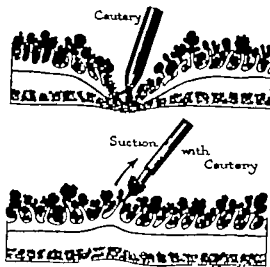


Fig 168 —Conventional ball point fulguration, which may destroy adjacent mucosa and bowel wall as polyp is pushed about by electrode, compared with suction-cautery method, which destroys polyp while it is held away from bowel wall. (Courtesy of Boehme E. J Ann. Surg 131:519-533 April, 1950)

and will be inspected periodically for the duration of the patients' lives

[It is fortunate that the opinion is becoming more or less unanimous that polyposis of the colon should be treated radically There can hardly be doubt any longer that this is a definite precancerous condition, one of the very few that are certain.—Ed.]

Benign Lymphoma of Rectum Elwyn L Heller and Homer H. Lewis, Jr [1] (Univ of Pittsburgh) report that in nine cases there was no preferential grouping by sex or age Benign lymphoma was usually detected during investigation of unrelated lesions. No patient had evidence of disease elsewhere in lymphoid tissues.

Most lesions were polypoid but intramural nodulation was noted occasionally The tumors varied from a few millimeters to 8 cm in diameter The lesion was usually solitary the mucous membrane was intact, and there was no site of predilection in the rectum Microscopically there was no evidence of a capsule The muscularis mucosae was

(1) Am. J Path 26 463-471 Ma 1950

sometimes replaced by infiltration of lymphocytes. Numerous lymphoid follicles with germinal centers were characteristic of the mass, and at times lymphoblastic cells showed mitotic figures.

Additional evidence supporting the benign nature of these tumors is their clinical behavior No recurrences have been reported Of 259 benign anorectal tumors, 3 per cent were lymphomas.

Conservative Surgical Management for Certain Rectal Adenomas Showing Malignant Change. To determine the value of local treatment of adenomas showing malignant change, Samuel McLanahan, Glenn P Grove and Richard F Kieffer, Jr[2] (Johns Hopkins Hosp) collected 38 cases in which local surgical measures had been used, sections had revealed definite malignant change and more than one year follow up was available The sex ratio was even, and ages were 26-76 Nearly three fourths of all patients remained cured during the observation period Five patients had simple recurrences, the lesions were benign or of no higher degree of malignancy than the original lesion. Another five patients had recurrences, identified as frank adenocarcinoma. The fact that most recurrences appeared within one year of the original operation and all within two years emphasizes the need for repeated observation of the polyp site during the first two years

Originally 15 of the 38 malignant adenomas were invasive and 23 were not The adenocarcinomas occurred in the group with originally invasive adenomas. The tendency of the tumor to invade the bowel microscopically is a poor prognostic sign and may be an indication for radical operative removal. Multiple recurrences constitute a poor prognosis even though pathologic examination may not demonstrate adenocarcinoma A patient with colonic adenoma has a predisposition for their formation and should have periodic thorough examinations Approximately 60 per cent of colonic adenomas can be seen through a 25 cm. sigmoidoscope. Those above this level may be detected by air contrast barium enema, an indispensable though not entirely reliable means of diagnosis

(2) J A. M. A. 141:8 1 826 Nov 19 1949

Surgical excision of these polyps is recommended because this is better treatment, the pathologist has an adequate specimen and prognosis can be formulated. Fulguration fails to allow for obtaining a specimen of the entire tumor Radical resection of growths of established malignancy is mandatory

Multiple Primary Carcinomas of Large Intestine. John F Thomas, Malcolm B Dockerty and John M Waugh[3], report that, among the patients who received surgical treatment for carcinoma of the colon or rectum at Mayo Clinic during 1907-44, 132 had multiple primary lesions (3 per cent) These were separated into a synchronous group in which the multiple lesions were present simultaneously at the time of operation and which consisted of 91 patients with 198 distinct carcinomas, and an asynchronous group in which a new primary lesion developed after removal of one carcinoma and which included 37 patients In addition, four patients exhibited both synchronous and asynchronous multiple primary lesions for a total of 13 carcinomas.

Incidence of multiple primary neoplasms is such that factors other than chance apparently influence their development in the same individual Senescence is not the cause, since mean age for patients with multiple lesions is no more than for patients with a single lesion. Heredity seems to be operative to a greater degree in patients with more than one cancer than in those with only one All this indicates a constitutional susceptibility to development of malignant tumors in some individuals. Therefore certain clinical applications are apparent especially with regard to carcinoma of the colon. Careful manual examination of the colon should be done at operation on a patient with carcinoma of the large intestine, since multiple lesions may not be diagnosed preoperatively All patients who have had resection of the colon for carcinoma should have regular re-examinations, since the possibility of development of another cancer is increased. Return of symptoms referable to the large bowel after resection of a carcinoma should not be considered to indicate recurrence or metastasis until possibility of a new primary lesion has been eliminated.

(3) Cancer 1 564-573 November 1948

This study indicates that there are more inherent differences between multiple synchronous and multiple asynchronous carcinomas than has heretofore been recognized, at least with regard to cancer of the colon and rectum. These differences are reflected in the fact that in the asynchronous group there are more men, a younger mean age for development of carcinoma, a larger percentage with a family history of cancer, striking differences in distribution of lesions in the large intestine and a higher percentage of patients with associated polyps. Also mean age for patients with polyps in the asynchronous group is considerably less than that for those without polyps, the converse is true for patients with multiple synchronous lesions. This study re-emphasizes the fact that all polyps of the colon are definitely precancerous lesions and should be treated accordingly.

Cancer of Colon and Rectum with Special Reference to Earlier Recognition of Alimentary Tract Malignancy, Secondary Delayed Re-entry of Abdomen in Patients Exhibiting Lymph Node Involvement, Subtotal Primary Excision of Colon, and Operation in Obstruction. Owen H. Wangensteen[4] (Univ of Minnesota) states that one in eight deaths is due to cancer. When greater emphasis is placed on early diagnosis, cures from cancer will multiply. Cancer is curable when the lesion is local. Lymph node metastases diminish considerably the chance of cure in any cancer. Alimentary tract cancers are responsible for about 50 per cent of all deaths from cancer, primarily because these cancers are silent. When they begin to cause symptoms, they have already been there probably 15-20 months. The only way in which cancer can be detected consistently in its early stages is to submit persons 45 or over to careful periodic examinations. The development of screening tests which can be performed in the physician's office will help to determine which patients should have special roentgen or other examinations. A better co-operative program for cancer detection between physicians and specialists is in the public interest.

Cancer of the colon and rectum since 1944 has been the

(4) Wisconsin M. J 48 591 59 July 1949

are presented by Urban Maes and I. M Esrig[6] (Touro Infirm., New Orleans) To achieve earlier diagnosis of these conditions attention must be directed toward earlier abnormalities of function than are described in many texts. Recurrent bouts of vague abdominal distress, darkening in color or specks of blood in or on the stools and gradually changing bowel habits may be of great importance in early diagnosis Few rectal cancers can be visualized by x rays, but about 70 per cent can be felt with the examining finger and almost 75 per cent of all large bowel cancers can be seen with the sigmoidoscope If a definitive operative procedure is feasible a one stage resection with end to-end anastomosis is advocated.

TECHNIC.—*The abdomen is entered through a left rectus-splitting incision with the patient in Trendelenburg position Spinal anesthesia is preferred. Unless there is evidence of widespread metastasis, resection is attempted. The peritoneum is incised at its reflection from the mesentery, and the major vessels are visualized, clamped, cut and ligated. The mesentery of the bowel is cut in a broad U, permitting maximal removal of lymph bearing tissue (Fig 169) Rubber shod clamps are placed on the near and far sides of the tumor to interrupt fecal flow As much bowel as feasible on both sides of the lesion is sacrificed, but it should be remembered that the two ends must be brought together without tension. With Allis clamps marking the site of resection, thin-bladed Payr clamps are placed at an angle of about 60 degrees to the mesenteric border The actual portion to be excised is clamped with Kocher forceps and the colon severed with a sharp knife. The open ends are swabbed with an iodine sponge. Payr clamps are removed, crushed tissue is trimmed off, and the viability of the margins are checked. If adequate blood supply is doubtful, more bowel must be resected. Because of the inequality in the diameter of the two ends of the intestine, the smaller end or both are usually slit for a varying distance on the antimesenteric border (Fig 170) End to-end anastomosis is then accomplished by a single layer of interrupted Connell U sutures with all knots tied in the lumen (Fig 171) Fine silk is used on a straight intestinal needle. The ends of adjacent appendices epiploicae are tacked over the suture line for added security Reperitonealization is accomplished, after which a Stamm type colostomy using a Pezzer catheter is done several inches proximal to the suture line. The suture line is then inspected, and sulfanilamide crystals are sprinkled over the area. The omentum is replaced and the wound closed in layers.*

If there has been no excessive weight loss and the abdominal wall is strong the peritoneum is closed with continuous catgut and the

(6) Ann. Surg. 130 1008 1023, December 1949

fascia with interrupted silk. If there is decided wasting the peritoneum and fascia are closed as a single layer, using Whipple's far-and-near figure-of-eight stitch, with medium chromic catgut. Babcock wire retention sutures placed through the fascia and fastened with Davey buttons are used if the fatty layer is very thick. No drains are used. If there has been unexpected spillage, the peritoneum alone is closed and the remainder of the wound packed with dry gauze. Secondary closure is then performed four to five days later when the fascia and skin may be closed with interrupted sutures.

During the procedure 500 cc. blood is usually given. Postoperatively blood is given as indicated. Penicillin is given routinely for





Fig. 169 (left).—U-shaped resection of mesentery rather than the usual V and annulation toward antimesenteric border as described by Madelung.
Fig. 170 (right).—Utilization of Cheatle slit on antimesenteric border to increase and equalize lumen.
(Courtesy of Mars, U. and Earle, L. M.: Am. Surg. 130:1008-1023, December 1949.)

four to five days. Fluids are given sparingly by mouth the first day and all liquids, except milk, freely on the second day. Sufficient intravenous fluids are given to insure a urinary output of 1,000-1,500 cc., depending on the patient's age and cardiorenal status. The patient is encouraged to sit up early. Frequent changes in position, leg exercises and stimulation of deep breathing with 10 per cent carbon dioxide are useful.

A right hemicolectomy is the standard procedure for lesions of the right half of the colon. Wide resection with end-to-end anastomosis is generally accepted for transverse colon lesions. The peritoneal reflection is the lowest limit for abdominal resection; for lesions below this line, a combined operation is preferred.

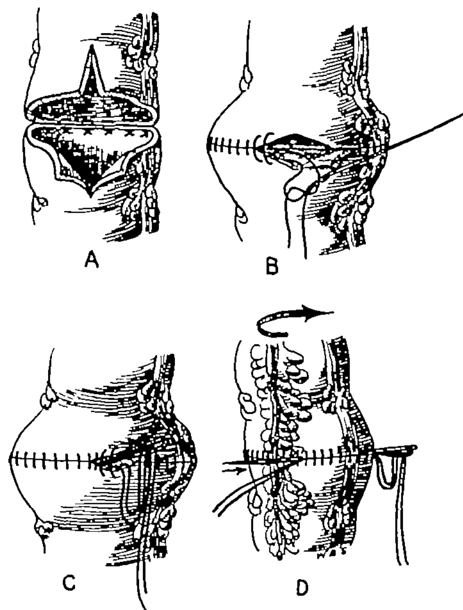


Fig. 171 —*A* and *B*, progressive steps in placement of Connell's suture. *C* and *D* method of securing final suture so that all knots are on inside, the only new feature of the suture as described by Connell. (Courtesy of Maes, U., and Eanrig, L. M.: Ann. Surg. 130: 1008-1022, December 1949.)

Of 17 patients seen before 1941 in whom antibiotics and sulfonamides were not used, resection was done on 13 with a mortality of 47 per cent. Six deaths were due to peritonitis. Since 1941, 53 patients have been treated, of whom 47 could have resection. All received sulfonamides and antibiotics.

There were two deaths, a mortality of 4.2 per cent. In these groups three fourths of the large bowel lesions were located in the sigmoid and colon and the rest in the rectum

Blood Supply to Sigmoid Colon and Rectum with Reference to Technic of Rectal Resection with Restoration of Continuity was investigated by J C Goligher[7] (St Mary's

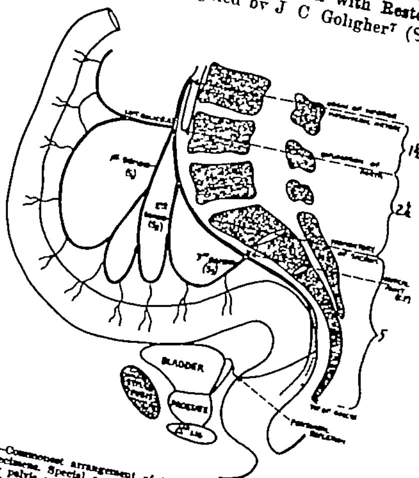


Fig 172.—Commonest arrangement of inferior mesenteric artery and its branches in autopsy specimens. Special care was taken to relate arterial tree and bowel accurately to bony pelvis and lumbar spine. (Courtesy of Goligher J C. Brit. J Surg. 37 157 162 October 1949)

Hosp., London) The distribution of the inferior mesenteric artery was examined post mortem in 75 adults Figure 172 is a composite diagram showing arrangement of vessels and related parts found in 40 specimens. The first sigmoid (S_1) and left colic ($L C$) branches arise conjointly and their common origin is opposite the bifurcation of the ab-

(7) Brit. J Surg. 37 157 162 October 1949

dominal aorta In five specimens the second sigmoid (S_2) arose with the left colic artery (Fig 173) In 30 specimens the left colic and first sigmoid arteries were separated at their origin by a gap of ½ ¾ in (Fig 174)

The anatomic study demonstrated that ligation of the inferior mesenteric vessels could be accomplished exactly

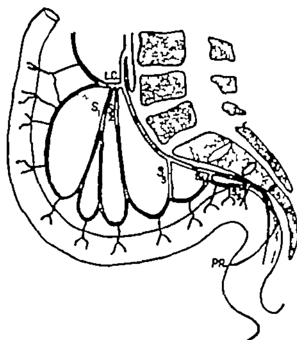


Fig 173 —Arrangement of vessels occasionally observed when sigmoid branches are specially numerous. Note conjoint origin of left colic artery (*L C*) and first and second sigmoid arteries (*S* and *S*) (Courtesy of Goligher J C Brit J Surg 37 157 162 October 1949)

as in a combined excision of the rectum and yet sufficient sigmoid colon reserved for re-establishing continuity After ligation of the inferior mesenteric vessels just below the common origin of the first sigmoid and left colic arteries, the first sigmoid is divided close to its origin (Fig 175) Reliance is placed entirely on the descending branch of the left colic artery and the marginal artery between it and first sigmoid for the blood supply for the stump Freeing of the descending colon is futile until the first sigmoid artery has been divided because the factor determining the extent to which the end of the stump can be brought down is the intact first sigmoid.

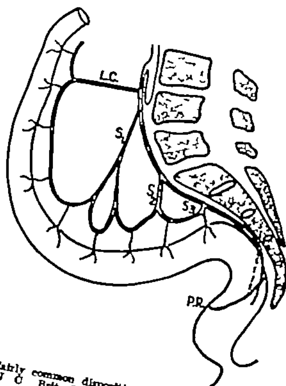


Fig. 174.—Another fairly common disposition of inferior mesenteric arterial tree. (Courtesy of Goligher J. C. Brit. J. Surg. 37:157-162, October 1949.)

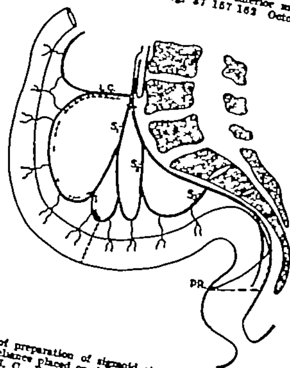


Fig. 175.—Method of preparation of sigmoid stump in which first sigmoid artery (S_1) is sacrificed and reliance placed on descending branch of left colic artery (*L.C.*). (Courtesy of Goligher J. C. Brit. J. Surg. 37:157-162, October 1949.)

This method most often permits end to-end union of the sigmoid with the anorectal remnant 1 in or so below the anterior peritoneal reflection In 12 cases continuity was restored by this method, and there was uneventful healing of the anastomosis with no evidence of necrosis. Although the superior and often the middle hemorrhoidal vessels were divided the blood supply to the anorectal stump after resection appeared surprisingly abundant and was probably derived from the inferior hemorrhoidal arteries and numerous unnamed branches in the anterior parts of the levator muscles

When restoration of continuity by an abdominoanal or pull through technic is contemplated a much longer colon stump is required This can be provided in only about half the cases since long stumps of this type seem specially liable to postoperative thrombosis of their vessels If the entire sigmoid colon must be sacrificed, it may be possible to resect up to the middle of the transverse colon and anastomose the remainder with the rectal stump or to use an ileal graft to bridge the gap between iliac colon and rectum

Appraisal of Operation of Anterior Resection for Carcinoma of Rectum and Rectosigmoid by John H Garlock and Leon Ginzburg[8] (Mount Sinai Hosp., New York City) is based on experience with 163 patients. Operative mortality was 7 2 per cent Operative results in the 151 survivors were appraised for various levels of the rectum, using the distance between the anus and the lower level of the tumor as determined by sigmoidoscopy In 20 tumors the lower level was 3-4 in. from the anus the recurrence rate on the suture line was 27 3 per cent and the recurrence incidence in the pelvis 10 5 per cent In 19 located at the 4-5 in. level recurrence rate at the suture line was 41 per cent while that in the pelvis was 12 per cent. As the distance from the anus increased the local recurrence rate decreased strikingly Of 31 patients with tumors located at 5-6 in. recurrences at the suture line and in the pelvis were similar—10 per cent The largest group of 81 tumors located at the 6-8 in level the rectosigmoid area, had recurrence rates of 4 4 per cent at the suture line and 1 4 per cent in the pelvis.

(8) Surg Gynec & Obst 90 525 534 May 1950

There is ample reliable statistical evidence that for cancers below the 3 in. level any operation short of abdominoperineal resection is not radical enough to meet the requirements of good cancer surgery This study shows that sphincter saving operations should rarely be used for cancers of the rectum below a level of 5 in from the anal margin With tumors at lower levels it is impossible to excise sufficient rectum (2-3 in) distal to the tumor to make the procedure an acceptable cancer operation

Other than the location of carcinoma in the rectum with respect to distance from the anal margin and results of follow up studies there are no preoperative or operative criteria which can guide the surgeon in choosing between anterior resection and abdominoperineal resection Neither the Dukes classification, the Broders histologic differentiation into grades nor lymph node spread can be used as an absolute criterion for a surgical procedure. Although size and gross type of rectal cancer cannot be used as an indication of spread to regional lymph nodes or criteria for selection of a particular procedure, large size of a lesion alone should not deter the surgeon from exploring to determine operability Penetration of the lesions to the serosa with local peritoneal implants or gross involvement of rectal fat calls for the most radical surgery

Failure of the suture line indicated by temporary fecal leaks occurred in about 5 per cent of the cases This low incidence is attributed to (1) thorough hemostasis (2) open anastomosis without clamps permitting accurate mucosal suture (3) avoidance of too many sutures minimizing the possibility of interference of local blood supply and (4) routine use of some type of proximal decompression of the colon. Proximal decompression makes for smoother convalescence and more rapid healing of the suture line

Palliative Resections in Cancer of Colon and Rectum. For the purposes of their study John Modlin and Howard S J Walker[9] classified as palliative only those resections in which definite evidence of irremovable cancer (usually distant metastases) existed before or was discovered during operation Thus, patients in whom distant metastases or

(9) Cancer 2 767 776 September 1949

local recurrence developed after curative resection are not included, and massive resections for locally advanced cancer have been eliminated if hope of cure, though minimal, existed in the surgeon's mind at the time of operation. This limitation of the type of operation considered palliative was made so that the value of such resections could be assessed more accurately Palliative resections accounted for 22 per cent of all large bowel resections for cancer at Ellis Fischel Cancer Hospital during 1947 and 1948. Over all resectability for patients with large bowel cancer seen at this hospital during this period was 54 of 62 cases (87 per cent)

The authors reviewed 35 bona fide palliative resections for cancer of the colon and rectum performed between 1940 and 1948 at Ellis Fischel Cancer Hospital, Columbia, Mo., and Barnes Hospital, St Louis. Twenty three patients had operations that produced a permanent abdominal stoma and 10 had resection and primary anastomosis (3 of these had concomitant temporary colostomies)

Despite previously expressed opinions to the contrary, there was no significant increase in length of life after resection in these 35 cases Nevertheless, worth while relief from symptoms was usually achieved. Operative mortality of 8 5 per cent does not appear excessive in the light of the palliation obtained One patient with pulmonary metastases has had good palliation for two years, and it is probable that more patients with such metastases should have resection of the primary lesion.

Secondary resections for curative or palliative purposes are to be considered a logical part of treatment of cancer of the colon and rectum. In two cases, no evidence of persistent cancer is apparent 6 and 18 months after secondary resection. In one patient a severe secondary anemia due to bleeding was corrected by a palliative right colectomy after initial abdominoperineal resection of the rectum.

Sphincter Preserving Operations for Rectal Carcinoma as Related to Anatomy of Lymphatics R. Russell Best and James B Blair[1] (Univ of Nebraska) find that these operations deserve further study and re-evaluation. Recurrence

(1) Ann. Surg. 130:538-550 September, 1949

of carcinoma of the rectum depends on and is the result of all modes of spread of carcinoma direct extension, venous channels, lymphatic channels and transplantation. In 607 collected cases, only 5 patients (0 8 per cent) had lymph node involvement more than 2 cm. below the lower margin of the tumor, yet it is estimated that 200 (about 33 33 per cent) of the patients died of recurrent carcinoma. Some factors other than node involvement below the tumor margin must be considered

After experimental studies by injecting dye into the lymphatics of the perianal, anal and rectal regions, a prac-

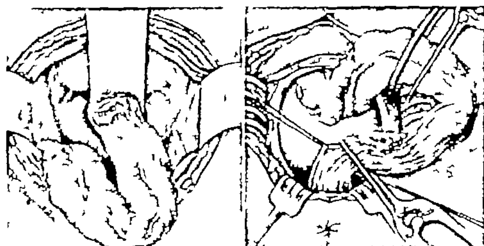


Fig. 176 (left) —Anterior dissection with posterior resection and anastomosis. Through abdominal incision, pelvic structures have been dissected and freed. Tumor which has been freed is replaced in the hollow of sacrum and pelvic floor peritoneum sutured around the rectum loosely enough to permit drawing the sigmoid down through posterior incision. A Gibson type cecostomy is done and abdomen closed.

Fig. 177 (right) —With patient on the left side, incision has been made along coccyx and sacrum, coccyx is removed, levator and structures are widely dissected and rectum and sigmoid are delivered and resected. (Continued in Figs. 178 and 179)

(Courtesy of Best, R. R., and Blair J B. Ann. Surg 130 538-556 September 1949)

tical classification of these lymphatics was made These lymphatic plexuses are drained by three groups of efferent channels—the inferior middle and superior—draining corresponding areas of the anorectal canal

Survival rate after radical abdominoperineal excision is not as good in patients with lesions below the 10 cm. level as in those with lesions at a higher level. Wide excision of structures laterally to include the levator ani muscles, fascia and lymphatics is recommended when the carcinoma

is located in the region of attachment or adjacent to the levator ani structures

For 10 years, and only in selected cases, Best has done a radical excision of carcinoma of the rectosigmoid region with immediate anastomosis of the colon to the rectal stump, and on occasion has anastomosed the ileum to the rectal stump Beginning in 1946 direct efforts were made to preserve the sphincter mechanism. Gradually, three different operations were developed

Operation 1 is entirely abdominal, with radical excision of the sigmoid rectosigmoid, mid and upper rectum for

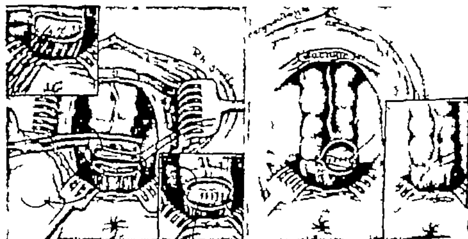


Fig. 178 (left) —Anterior dissection with posterior resection and anastomosis (cont.) Traction sutures of catgut are placed at both angles of anastomosis so that knots will be on mucosal wall. Layer of interrupted catgut sutures is inserted on anterior wall with knots on mucosal side inverting margin of anastomosis. All sutures are inserted before any are tied.

Fig 179 (right) —Several similar sutures, with knots on mucosal side are inserted on posterior wall. Anastomosis is completed by inserting layer of figure-of-eight silk sutures on posterior wall, lateral walls and as far as possible on anterior wall. Incision is closed and a Penrose drain is placed in hollow of sacrum and brought out at upper angle of incision.

(Courtesy of Best R. R. and Blair J B.: Ann. Surg 130:538-556 September 1949)

lesions at or above the 10 cm level from the external margin of the anal canal provided it is possible to transect the rectum at least 3 5 cm. below the lower margin of the lesion and effect an end to-end anastomosis. Operation 2 (Figs 176-179) is the combined abdominoperineal procedure in which the dissection and freeing of the upper zones of spread are done from within the abdomen then the patient is turned on the left side and further dissection and resec

tion and the anastomosis are done through a sacral incision This operation is indicated for lesions between the 5 cm and 10 cm levels. Operation 3 perineal dissection, resection and anastomosis, is done entirely through the posterior approach, it is not a fundamentally sound operation for carcinoma of this area because the zone of upward spread can not be adequately removed however it may be the operation of choice in some poor risk patients when the entire lesion is palpable rectally and in some other unusual circumstances The lower margin of the tumor should be at least 2 5 cm above the upper margin of the muscular anal canal.

Operation 2 is recommended for all lesions below the 10 cm. level, as it permits radical excision of the levator structures

For lesions involving the perianal skin and not the true anal canal, radium treatment with or without irradiation or dissection of the inguinal lymphatics, seems sufficient Malignant lesions in the anal canal should be extirpated by radical abdominoperineal resection

In patients who have had sphincter preserving operations, there is a better opportunity to examine and detect recurrence in the pelvis. Abdominoperineal resection can then be done and the patient given another chance to survive the disease

In 51 recent consecutive cases of rectal carcinoma the operability rate was 86.2 per cent and resectability rate 74 5 per cent In patients with resectable lesions a sphincter preserving operation was performed in 76 3 per cent and abdominoperineal resection with sacrifice of the sphincter was done in 23 6 per cent Among the resectable cases there were two deaths (5.2 per cent of the resectable cases and 6.8 per cent of the cases of rectosigmoidectomy with anastomosis)

Carcinoid Tumors of Colon and Rectum. Robert C Horn Jr [2] (Univ of Pennsylvania) analyzes experience with 18 carcinoid tumors of the appendix, 13 of the large bowel 2 of the ileocecal valve and 3 from which material was obtained by biopsy of metastases

(2) Cancer 2 19 836 September 1949

In four of the five cases of large bowel carcinoid, all findings were those of carcinoma Only histopathologic examination indicated the correct diagnosis. One tumor was found incidentally in a patient who died of hypertension. A striking contrast is presented by two cases of carcinoid of the transverse colon In one there was an extensive, freely invasive tumor, without evidence of lymph node metastases, which grossly resembled carcinoma, but the patient was still well four years later The second patient had widespread



Fig 180 —Carcinoid of rectum. Ribbons and festoons so often seen in rectal carcinoids. Hematoxylin and eosin (reduced from × 340) (Courtesy of Horn, R. C., Jr Cancer 2 819-836 September 1949)

metastatic disease and died in hepatic failure One patient with rectal carcinoid showed extensive metastatic lesions from an inconspicuous primary tumor (Fig 180) Rectal carcinoid was observed in five other patients but in each instance a small tumor was discovered only because proctoscopic examination was performed for other reasons.

These results emphasize that carcinoid tumors may occur in many sites in the intestine and present varying histologic pictures Argentaffin granules were demonstrated in only 6 of the 18 cases in this series. The most notable feature

is the frequency with which carcinoids of th rectum do not give rise to local symptoms reg whether metastasis has occurred Most of these tumo unencapsulated and locally infiltrating, although metast took place in only 7 of 18 extra appendical carcinomas an in none of the 18 appendical tumors Survival periods may be remarkably long despite extensive inoperable metastases

Squamous Cell Epithelioma of Rectum. Leo J LeBlanc, Louis A. Buie and Malcolm B Dockerty[3] (Mayo Clinic) reviewed 130 cases in which diagnosis was rectal or anorectal squamous cell epithelioma The majority of the lesions were anal squamous cell epitheliomas which had or had not involved the mucosa of the rectum secondarily Only five could be classified as rectal squamous cell epithelioma The three women and two men with this lesion ranged in age from 48 to 71. The cardinal symptom was rectal bleeding

All five growths were in the lower third of the rectum but entirely above the dentate line They varied in area from 16 to 40 sq cm and in thickness from 1 to 2 cm. The cellular pattern was characteristic of squamous cell epithelioma. Evidence of fixation was reported in three Graded by Broders method all lesions were of high grade malignancy The squamous cells probably originated from regenerative cells, situated in the depths of intestinal crypts, which have a pluripotential ability to produce the type of epithelium needed for a given purpose i e mucous cells for secreting purposes or squamous cells for protective purposes

One patient was treated with radium and the others by more or less radical operation, the treatment of choice. Prognosis is poor for one patient died of recurrence after six years, one survived two years and one could not be traced. The others were alive three months and two years postoperatively

Epithelioma of Anus Harlow B McQuarrie (Mayo Found.) and Louis A. Buie[4] (Mayo Clinic) analyzed 137 cases of malignant anal neoplasm of epidermoid origin. Squamous cell epitheliomas occurred in 92 per cent the ratio of men to women was 2 3, and average age was 55.8 Patients complained of pain, bleeding, mucopurulent dis-

(3) Ann. Surg. 131 392-399 March, 1950
(4) Postgrad. Med. 7 402-409 June 1950

charge and other bowel irregularities. There were unhealed wounds following recent anal operations performed elsewhere in 20 per cent of the patients Grossly, small areas of dermatitis, abrasions, fissures, various ulcers indurations, abscesses or fistulas were present In the men the tumors were fairly evenly distributed along the anal canal, but in the women four times more tumors were situated high in the canal than in the lower portion. Palpable inguinal nodes were noted in 15 per cent anemia in 8.5 per cent and weight loss in 30 per cent. About 40 per cent of the tumors were low or moderate grade malignancies and the remainder were high grade Those high in the anus were generally of high grade and those in the lower position were *generally of low grade In 86 cases the lesion originated* in the anus and invaded the rectum. Perirectal nodes were involved in 30 per cent of 47 surgically excised specimens. Of 42 patients treated by radical posterior excision rectal amputation or combined abdominoperineal resection and followed at least five years after operation 19 were living five years after treatment was completed. Of 44 observed for five years after radiation therapy 7 were living five years after treatment had been begun

There were seven cases of melanoepithelioma Usually the tumors originated high in the anal canal and spread cephalad beneath the submucosa of the rectum Symptoms were mild and indefinite and developed late in a rapid course Average duration of symptoms before initial examination was 9 weeks, compared with 10 months in the patients with squamous cell epithelioma. All the patients except one died within a few months despite wide excision and x ray therapy

Basal cell epithelioma occurred in two patients, both of whom had long histories of symptoms referable to the anus. The tumors developed low in the anal canal, and there was no evidence of metastases.

Annular Rectal Stricture Resulting from Complete or Incomplete Internal Fistula in Ano Newton D Smith and John R Hill[5] found 12 such cases (3 per cent) among 400 strictures due to a variety of causes There were four men

(5) S Cl North America 29 1116 1117 August 1949

and eight women, and all were white except one woman Six patients were given a Frei test with negative results In one woman the tissue removed at operation revealed tuberculosis

Preoperative diagnosis of rectal stricture resulting from complete or incomplete internal fistula was made in only five cases, and the possible etiologic relationship was suspected in two more The underlying pathologic process in five patients was obscured by previous surgical procedures or injection treatment for hemorrhoids Eight patients had been treated surgically elsewhere without relief The failures seemed to result from erroneous diagnosis or incomplete exposure of all the fistulous tracts

In three instances there were large abscess cavities with thick fibrous walls in addition to the fistulous tracts In four women tracts extended externally into the labia and perineum, and in two of them into the vagina in three of them the fistula involved the right and left sides of the anus and rectum. In six cases extensive surgery was required and in three a more extensive procedure than would be necessary for routine internal fistulectomy in three the surgical procedure was not unusual.

The primary opening was in the posterior midline at the level of the dentate margin in nine patients in the dentate margin of the anterior midline in two women and on the left anterior quadrant of the anus at the level of the dentate margin in another woman.

All but one patient had good results and this patient may improve further The stricture cleared up reasonably soon after the fistulous tracts and abscess cavities had been uncovered and ample drainage insured. In three cases the amount of destruction of tissue by the inflammatory process was excessive causing poor control in two of them before any surgery was attempted Several other patients had difficulty in controlling stool evacuation before operation and remarked that when the structure had been cured this difficulty subsided

Value of Thoracoabdominal Incision in Removal of Kidney Tumors Richard Chute, Lamar Soutter and Walter S. Kerr, Jr[6] (Massachusetts Gen'l Hosp) used this approach in 39 urologic operations on the kidney most of which were nephrectomies for kidney tumors The patients ranged in age from 1 to 77 years. There were no operative or post operative hospital deaths

The incision offers a much wider and better exposure of the kidney and its vascular pedicle than the extraperitoneal lumbar or transperitoneal approaches Other advantages include greater ease and safety in securing the vessels of the pedicle less manipulation of the kidney before the vessels are secured thereby minimizing the probability of squeezing malignant tumor emboli into the blood stream, easier removal of large and extensive kidney tumors, increased opportunity to remove tumor extension to adjacent structures and elimination to a large extent of the often dangerous hemorrhage of large veins that run over the surface of some kidney tumors

METHOD.—If nephrectomy is to be on the left a Levin tube is placed in the stomach immediately before operation. Under intratracheal oxygen-ether anesthesia the patient is placed on the table with the side to be operated on uppermost. The incision starts about 1 cm. lateral to the spinous processes of the spine in back and runs forward and downward over the entire course of the tenth or eleventh rib (Fig 181) It is continued in the same direction across the abdominal wall as far as the lateral border of the rectus muscle. The entire rib is removed subperiosteally The pleural cavity is entered through the periosteal bed care being taken not to injure the underlying lung The lung is walled off with moist gauze and kept expanded during operation. The phrenic nerve may be crushed or injected with 2 per cent procaine solution to provide diaphragm paralysis during the procedure. The diaphragm is then incised in line with the skin incision, care being taken to avoid cutting into any organ that may be adjacent to its underside. The diaphragmatic incision is carried forward through the decussation of the diaphragm with the transversus abdominis muscle and through the oblique muscles as far as the outer border of the rectus muscle (Fig 182) A

(6) New England J. Med. 241 951 960 Dec. 15 1949

Finochietto rib retractor is used to separate the ribs, and the kidney then bulges up into the wound. The spleen or the liver may be retracted or packed upward out of the way. The renal tumor is gently retracted laterally, the intestine freed from its medial aspect and the renal vein exposed and dissected out cleanly (Fig 183). Dissection of the pedicle is then continued under direct vision, and when the main renal artery is exposed the vein and artery are individually clamped, sectioned and doubly ligated. The perinephric fat, all lymph nodes and areolar tissue in the pedicle region or adherent to the great vessels are dissected away and removed *en bloc* with the tumor. The ureter is sectioned and ligated, the cut ends being cauterized. Mobilization of the kidney is then completed, and it is removed. The raw area is reperitonealized and bowel placed in posi-

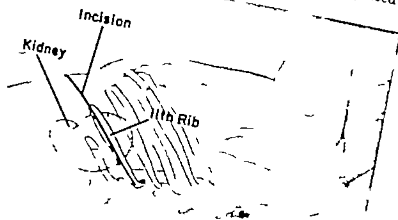


Fig. 181.—Schematic drawing showing location of thoracoabdominal incision in relation to kidney. (Courtesy of Chute R. *et al.* New England J. Med. 241:951-960, Dec. 15, 1949.)

tion. The opening in the peritoneum is closed anteriorly as far as the diaphragm with a continuous suture of plain 0 catgut on an atraumatic needle. The diaphragm is sutured with interrupted stitches of no. 2 silk. Before the chest is closed 1.5 cc. eucupine in oil is injected into the intercostal nerve of the resected rib and the nerve of the rib above and below. The pleura is closed with interrupted silk sutures, the last two being placed but not tied until the lung is completely re-expanded by the anesthetist. The remainder of the wound is closed in layers with silk. If the lung leaks air on application of positive pressure or if there is persistent oozing of blood into the pleural cavity, the chest must be drained. For this purpose a no. 22 Foley catheter with a 30 cc. bag is inserted through a tiny stab wound in the chest about two interspaces above the incision in the axillary line. The bag is inflated, the

to the chest wall by a skin stitch and the catheter connected to a three bottle chest suction drainage apparatus with 8 cm. negative pressure for 48 hours. A transfusion of 1 000 cc. whole blood is

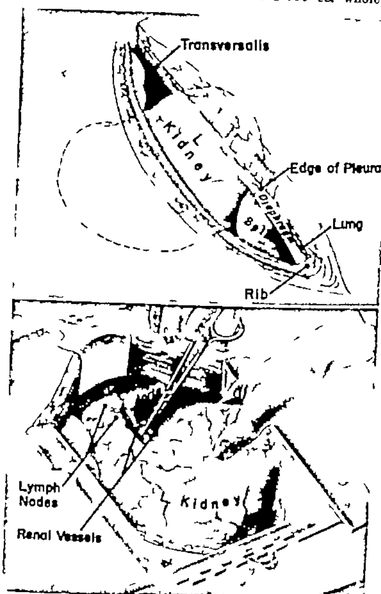


Fig. 182 (top).—Peritoneal cavity widely opened.
Fig. 183 (bottom).—Tumor being gently retracted laterally and colon separated from anterior medial surface.
(Courtesy of Chute, R., *et al.*: New England J. Med. 241: 951-960, Dec. 15, 1949.)

given during the operation and thereafter blood is given only as indicated. The technic for the right side is similar.

Postoperatively digitalis, quinidine or antibiotics are given as needed. The patient is turned hourly and oxygen is given by nasal

catheter until there is good aeration of both lungs. The Levin tube is attached to suction for a day or two Morphine should be administered early and frequently Intravenous fluids should be administered slowly and without saline solution unless the patient is young and cardiac status is good The patient is allowed up on the first postoperative day and is usually ready to go home in about 10 days.

Acute Temporary Changes in Renal Function Associated with Major Surgical Procedures, according to Carl A. Moyer[7] (Southwestern Med College), cannot be ascribed to alterations in renal blood flow to water sodium or chloride deficit to blood loss or to action of the anesthetic agent The only apparent possible causes are distributional shifts of body fluids and the afferent stimuli arising in the operative area The most prominent changes are (1) a profound reduction in rate of excreting water and urea (2) a severe inhibition in rate of excreting sodium salt solutions, (3) a reversal of the relation normally existing between rates of excreting salt and water of sodium salt solutions of varying tonicities and (4) a greater reduction in excretion rate of the chloride than in excretion rate of the sodium of the NaCl solution injected.

The following is a rough guide to postoperative use of fluids. During the period of postoperative inhibition of water diuresis an attempt to force a rapid flow of urine by injection of 5 or 10 per cent glucose in distilled water should not be made because of the risk of inducing dangerous intoxication with water The amount of glucose in distilled water given should be limited to the patient's need for water Except for the summer months, 1,500-2,000 ml./day is sufficient. In general, during the summer, for every 5 degrees the noon temperature is above 90 F., 1,000 ml should be added to this figure Saline solutions should only be given during the immediate postoperative period when specific indication, such as signs of extracellular fluid volume deficit or rapid loss of sodium through suction tubes and fistulas, is present If indicated a 0 6-0 7 per cent solution is preferred because its use is not attended by changes in concentration of sodium and chloride in serum that tend to follow injection or 0 9 or 0 45 per cent solutions When sodium needs to be given while a normal or low carbon

(7) Surgery 7 198-20 February 1950

dioxide-combining capacity is present, Hartmann's solution is physiologically preferable to NaCl solution, because the latter tends to cause dilutional acidosis during the post operative period when chloride excretion is inhibited. When saline solution has to be given while a distinctly elevated carbon dioxide-combining capacity exists, a solution of NaCl is physiologically better than Hartmann's solution (lactated Ringer's solution)

Clinical Experiences with Artificial Kidney Charles B Ripstein, John T MacLean, Nannie K. M. DeLeeuw and G Gavin Miller[8] (Montreal) state that the types of uremia in which dialysis is of value can be summarized as follows (1) acute renal lesions with uremia—fulminating acute glomerulonephritis and acute poisoning by mercury phenol and salicylates, (2) lower nephron nephrosis type of lesion—anuria following incompatible transfusion, sulfonamide administration, crush syndrome, severe burn and eclampsia, (3) anuria following prolonged hypotension, postoperative anuria (4) preparation of the uremic patient for an operation—prostatic obstruction and kidney infections. In the past seven months the authors have treated six cases of uremia with the artificial kidney

Effect on Blood Chemistry—Blood nonprotein nitrogen level drops at a rate of 10-30 mg/100 cc/hour while that of the bath water increases in proportion. Diffusion rate slows as dialysis progresses, but it has never been necessary to change the bath within eight hours Gradual fall in blood calcium level can be prevented by giving the patient 10 Gm. calcium gluconate intravenously every three hours. The tendency to acidosis is overcome by giving 500 cc of M/6 sodium lactate intravenously when carbon dioxide-combining power falls below 50 Hyperglycemia must be avoided in diabetic patients Administration of insulin may be advisable

Effect on Circulating Blood—It is far better to use too much heparin than too little An initial dose of 150 mg is given intravenously and another 150 mg is run through the kidney Since metal inactivates heparin glass cannulas and connections are used. During dialysis 50 mg heparin is

(8) Surgery 26 229-236 August, 1949

added to the circuit every 90 minutes. At the end of treatment the heparin is neutralized by giving 10 cc of a 1 per cent solution of protamine sulfate intravenously

Effect on the Patient—The process of dialysis is well tolerated even by the poor risk patient. The machine constitutes an arteriovenous shunt, but its capacity is only 200 cc a minute, not enough to embarrass the circulation The rapid return of blood into the right side of the heart may theoretically cause a rise in venous pressure and lead to pulmonary congestion, but so far the authors have observed no harmful effects. No other significant effects have been noted except that an occasional patient has felt subjectively improved after a period of treatment.

Substitution of Isolated Segment of Sigmoid Colon for Urinary Bladder J Dewey Bisgard and H. Harper Kerr[9] (Omaha) planned a two stage operation and carried it through to completion in five of seven dogs in which it was attempted. The technic is outlined in Figure 184. The second stage is performed two weeks after the first.

The five dogs remained well and appeared normal until killed for specimens two were killed four months after operation, one at one year and two at two years. In all animals urinary continence developed a day or two after removal of the urethral catheter Periodic catheterizations never recovered over 60 cc urine, and 60 cc. instilled water was retained 15 minutes or longer in every instance Extent of voluntary control of the substitute bladder could not be definitely determined. Motor activity of the sigmoid bladder was investigated in two animals the rhythmic contractions and segmental peristaltic waves normally observed in the colon remained unaltered despite the change of function. Eserine increased tonicity to the point of spasm, and atropine produced the usual response At no time was there subjective evidence of infection of the urinary tract in any animal and autopsy showed no evidence that infection of the urinary tract existed or had ever existed.

The success of this operation in animals raises the question of its applicability to man. It is a much more formidable procedure than the Coffey type of operation and it is doubt

(9) Arch. Surg 59 585-593 September 1949

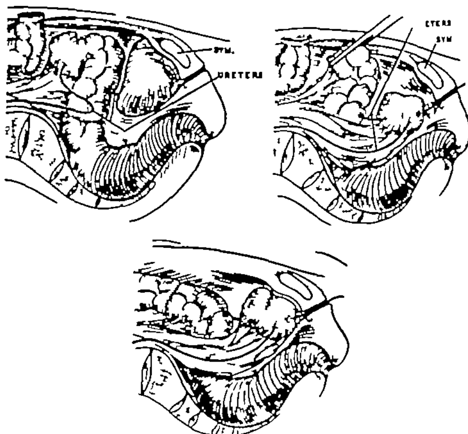


Fig 184 —*A* first stage Right ureter is transplanted t segment of sigmoid colon to be used subsequently as substitute bladder Bowel is divided above this point, distal end infolded and proximal end exteriorized as colostomy *B* and *C*, steps in second stage Completed bladder transplantation f left ureter, isolation of sigmoid bladder and suture of its distal free end to urethra and re-establishment of colon continuity (Courtesy of Bisgard, J D and Kerr H H. Arch. Surg 59 588-593 September 1949)

ful that its possible advantages would compensate for the increased operative risk except when benign lesions necessitate total removal of the bladder In exstrophy, the open exteriorized urethra makes this operation impossible In malignant disease, adequate resection often includes a portion of the urethra, including the prostate in the male and with it the prospect of loss of continence

Electrolyte Pattern of Blood after Bilateral Ureterosigmoidostomy Deward O Ferris and Howard M. Odel[1] (Mayo Clinic) studied 141 cases In 112 (79 per cent) hyperchloremia developed plasma chloride level was 103 131 m.

(1) J A. M. A. 142 634-641 Mar 4 1950

Eq./L. In 113 (60 per cent), acidosis developed plasma bicarbonate level was 6-23 m. Eq./L. In 14 of 16 cases (88 per cent) in which two stage operations were performed, hyperchloremia developed after the second ureter was transplanted. The interval between transplantation and an elevated chloride value varied from two days to nine years, but in most cases hyperchloremia developed within one year. This also applied to acidosis.

There seemed to be evidence that in these cases hyperchloremic acidosis occurred because of chloride absorption across the rectal mucosa from urine stored in the rectum and sigmoid. The manner in which chloride is absorbed is not entirely clear. Some may be absorbed as sodium chloride but it is probable that the greater part is absorbed in a manner which is unknown.

Hyperchloremic acidosis is accompanied by a rather characteristic syndrome fatigability weakness, anorexia weight loss, salty taste nausea and vomiting nitrogen retention, polydipsia and diarrhea (polyuria). These symptoms are promptly relieved by correction of the acidotic state. Control or prevention of hyperchloremic acidosis developing after bilateral ureterosigmoidostomy is possible by careful attention to values for chloride and carbon dioxide-combining power by avoidance of parenteral use of sodium chloride solution in the early postoperative period, unless there is chemical evidence of a chloride deficit, and later by use of a low chloride diet augmented by doses of sodium bicarbonate. If a commercial salt substitute is used, care should be taken that the product does not contain one or more "chloride" salts. The patient must be instructed not to hold urine in the rectum longer than necessary.

The degree of salt restriction in the diet and the dosage of supplementary sodium bicarbonate cannot be standardized but must be regulated according to the electrolyte response in each patient. Therefore it is of utmost importance that chemical determination of the electrolytes in the patient's blood particularly chloride and bicarbonate be made periodically.

As an example of management in an early case a patient was placed on the routine low salt diet (0.5 Gm. Na). In addition about 16 Gm. $NaHCO_3$ was given daily to com

pensate for the sodium deficiency in the diet Six days after this regimen was instituted, alkalosis developed owing to the excessive amount of sodium bicarbonate ingested. Within 24 hours after sodium bicarbonate administration was discontinued, carbon dioxide-combining power returned to normal. As a result of this experience, the next few patients were instructed to follow the same diet but were given only 4 Gm $NaHCO_3$ daily This proved more satisfactory and maintained blood electrolytes essentially within normal limits. However in two patients who returned for re-examination, a tendency to hypochloremia and hyponatremia was noted. Therefore, in more recent cases a more liberal diet containing 1 6 Gm Na and 2.2 Gm. CL daily was given One patient who remained on this regimen for five months recently returned with an entirely normal blood electrolyte pattern.

Interstitial Cell Tumors of Testis Male Sex Hormone. *The consensus is that the interstitial cells of the testis* secrete male sex hormone Simple hyperplasia of these cells is relatively frequent, but new growths are extremely rare, since only 40 proved cases are found in the literature, 7 of which occurred in children under 12 K. B Fraser[2] (Brisbane) reports a case

Boy aged 4 years and 2 months, whose penis had gradually increased in size after he was 2, had frequent erections and the general conformation of a boy of at least 10, voice was low pitched and the penis 7 6 cm. long and 8 6 cm. in circumference he had a beginning of downy pubic hair The left testis felt rather larger than the right. Bone age was two years in advance of chronological age. Nothing was found to suggest adrenal cortex tumor or cerebral lesion. Three months later the penis was 8.9 cm. long and 9.5 cm. in circumference the left testis seemed to have increased in size, and the pubic hair was more noticeable darker and coarser than when first seen. The left testis was removed. Apart from moderate enlargement, there was nothing to indicate a tumor but section revealed a spherical brown mass lying more or less centrally in what appeared to be normal testicular tissue. It was histologically diagnosed as an interstitial cell tumor of the testis.

Three months after operation he had no more erections, pubic hair was softer and somewhat thinner and the penis was 7.3 cm. long and 7.9 cm. in circumference. After another two months the penis had not changed in size but pubic hair had practically disappeared.

(2) Australian & New Zealand J Surg 19 48 57 August, 1949

The diagnosis seemed well established in this case on both clinical and pathologic grounds The sharp line of demarcation between the tumor and the surrounding tubules, the difficulty in finding any isolated collections of interstitial cells apart from the tumor and the normal character of the tubules are all features that pointed to tumor formation as distinct from simple hyperplasia The presence of macrogenitosomia which retrogressed after unilateral orchiectomy is confirmatory evidence that the clinical manifestations were due to the tumor Although abnormal genital development is a feature of all cases in children, sex changes in adults have been limited to gynecomastia in a few instances some such tumors in adults have been malignant, but all in children have been benign. The similarity of ages at which symptoms have appeared in children is striking (4-6 years) This period is not associated with any demonstrable changes in normal interstitial cells, but some endocrine factor yet undiscovered may play a part in tumor formation during this age period. More rapid and more complete retrogression occur when operation is done soon after onset of symptoms.

ADRENAL GLANDS

Pheochromocytoma Use of N,N Dibenzyl B-Chloroethylamine (Dibenamine) and Piperidino-Methyl Benzodioxane (Benzodioxane) in Surgical Therapy Neil N Litman and David States (Univ of Minnesota) state that only eight cases of pheochromocytoma have been reported in children under age 13 Differential diagnosis of the tumor is essentially that of hypertension in children. A case follows.

Girl, 11, was admitted with presumptive diagnosis of acute glomerulonephritis, but absence of azotemia with sustained hypertension led to the belief that glomerulonephritis was not the primary lesion. Other causes of hypertension were considered, including pheochromocytoma. The mother stated that the patient had had an attack of headache nausea and vomiting at age 2, which was diagnosed as heat stroke since then attacks had recurred once or twice a year Shortly the patient had a convulsive seizure involving the entire body Blood pressure was 205/155 mm. Hg in the left arm

(3) Pediatrics 4 735-743 December 1949

and 250/150 mm. in the left leg Phlebotomy with removal of 200 cc. blood had little effect on blood pressure. Dibenamine, 6 mg./kg body weight, was given intravenously the period of reduced blood pressure lasted 41 hours before stabilizing at 160/110 mm. Hg The drug was given again three days later with similar results. Tetraethylammonium chloride was given intramuscularly in doses of 100-300 mg, a slight rise in blood pressure resulted from each injection. Examination revealed increased papilledema but normal neurologic findings. Up to this time, clinical course had been characterized by instability of temperature with no obvious infection, excessive perspiration, polydipsia, polyuria, lethargy and loss of memory Benzodioxane compound 933F was given 10 days after admission in conjunction with saline drip as recommended. A striking drop in blood pressure resulted immediately, and a repeat test the next day had the same effect. An intravenous pyelogram showed no tumor mass in the adrenal region but pheochromocytoma was considered the most likely diagnosis.

Dibenamine was given preoperatively to prevent excessive rise in blood pressure which might occur from manipulation of the tumor A mass involving one third of the right adrenal gland was found. Gentle manipulation of the tumor caused no rise in blood pressure, which was 150/90 The tumor was easily enucleated. After its removal, blood pressure fell precipitously to a level too low to measure and the pulse became thready Epinephrine, adrenal cortex extract and transfusion as well as cardiac massage and epinephrine injection into the myocardium, were of no avail. The patient died. Histologic diagnosis was pheochromocytoma of the adrenal gland.

Dibenamine was useful in establishing diagnosis in this case, but its preoperative use was apparently ill advised. This case confirms the belief of others that benzodioxane compounds are helpful diagnostic aids and that tetraethyl ammonium chloride is of little value in the establishment of diagnosis or in treatment of the tumor The mortality rate following surgery of pheochromocytoma in children is extremely high of seven cases operated on, four (58 per cent) died

Pheochromocytoma Its Diagnosis and Treatment. Four cases in which symptoms had persisted from 4 months to 20 years and which responded to surgery are reported by Elmer C Bartels and Richard B Cattell[4] (Lahey Clinic) Any person with vasomotor attacks and associated symptoms such as excess sweating with blotchiness of the skin toxemia during the early months of pregnancy fluctuant or sustained hypertension or suspected hyperthyroidism

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may have a pheochromocytoma The most important diagnostic laboratory findings are elevated blood sugar, diabetic glucose tolerance tests elevated metabolism without goiter, or abnormal pyelograms showing displaced kidney or calcification Histamine, mecholyl* or etamon* chloride may be useful in producing a typical hypertensive attack in patients with pheochromocytoma, but a negative response does not rule out tumor Surgical removal of the tumor is followed by cure unless the pheochromocytoma is malignant and has metastasized or has produced serious vascular damage

TECHNIC.—Ethylene-ether or cyclopropane-ether administered through an endotracheal tube provides the best anesthesia. Since induction may precipitate hypertensive reaction an intravenous needle should be inserted previous to anesthesia to permit rapid administration of whatever medication may be required. Hypotension followed by collapse indicates acute left heart failure from excessive circulating epinephrine which produces increased peripheral resistance. In surgical shock or lowered blood pressure adrenolytic drugs should be given intravenously to combat the hypertensive reaction and Trendelenburg position used to avoid cerebral anoxia associated with hypotension which may continue a few hours postoperatively but need not be feared. Since there is no epinephrine deficiency this condition should not be treated with intravenous epinephrine Intermittent administration of dibenamine intravenously in doses totaling 60 175 mg was used to combat hypertensive reaction in two patients. Further experience will be needed before its proper use is determined

The operation is usually best carried out by the regular kidney incision, but for a large tumor better access is gained by removal of the twelfth rib taking care to avoid opening the pleura. The kidney is displaced downward and medially after which the fascia is incised to expose the adrenal gland. The abdominal approach may be used for large tumors, particularly on the left side or when general exploration is indicated Both adrenal glands should be explored since in 10 per cent of cases the tumors may be multiple or there may be congenital absence or atrophy of the other gland. The approach to the left adrenal is similar to that for the tail of the pancreas through the gastrocolic omentum. Compression of the tumor should be avoided and the vessel pedicles dissected and clamped as early as possible. Partial or total adrenalectomy should be carried out, depending on the findings. If invasion is noted operation should be performed as indicated and probably should include nephrectomy

A hypertensive reaction during any operative procedure should suggest a pheochromocytoma This reaction constitutes an acute emergency not unlike cardiac arrest and one

of the following courses must be instituted. (1) Immediately stop the operation, and after the patient's recovery submit him to further investigation. (2) In intra abdominal operations explore the adrenal and sympathetic chain areas and remove any tumor (3) Control the hypertension with an adrenolytic drug and complete the initial operation. Postoperatively, presence of a pheochromocytoma should be confirmed

Levels of Circulating Eosinophils and Their Response to ACTH in Surgery Use as Index of Adrenocortical Function. M. Roche G W Thorn (Harvard Univ) and A. G Hills[6] (Univ of Pennsylvania) used a modification of the Dunger method to measure the eosinophil levels and then administered 25 mg ACTH intramuscularly or 0 3 mg epinephrine subcutaneously A fall of 50 per cent or more from the initial level in the eosinophil count four hours after administration of either drug indicated normal adrenocortical or pituitary adrenocortical reserves, respectively

The eosinophil levels were followed every half hour during operation in 3 patients, immediately after operation in 50 and during the postoperative period in 18 The effect of preoperative anxiety and of anesthesia on the eosinophil level was also studied.

Measurement of fall in eosinophils after preoperative injection of 25 mg ACTH is a good index of adrenal cortex capacity to excrete 11-oxysteroids and furnishes a good means of preoperative prognosis.

In normal adrenal cortex activity there is an almost complete disappearance of circulating eosinophils during the first 24-48 hours after a major operation. The finding of *an eosinopenia during the same period is in itself* evidence of increased adrenal cortex activity Conversely the finding of a normal or high eosinophil level during the first 24-48 hours postoperatively suggests adrenal cortex insufficiency

There is usually a sharp rise in the eosinophil level on the second to fourth postoperative day associated with clinical improvement. This "third day eosinophilia" is associated with return of normal adrenocortical reserve

Response of the eosinophils to ACTH during the post

(6) New England J Med. 242 307 314 Mar 2, 1950

operative period provides a rapid and useful means of assay ing adrenocortical reserve, whereas the epinephrine response may give equivocal results at this time

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EXTREMITIES

Disarticulation of Innominate Bone (Hemipelvectomy) for Primary and Metastatic Cancer has recently received renewed interest. Eight cases in which this procedure was done are reported by Irving M. Ariel (Univ of Minnesota) and Fred W Hark[6] (Veterans Admin Hosp., Hines, Ill.) The entire innominate bone, continuous somatic tissues and subjacent lower extremity are resected en masse At times it is necessary to resect other viscera such as the peritoneum, testis and spermatic cord. The operation is indicated for neoplasms of the hip, pelvic parietes or soft tissues of the iliac region which cannot be extirpated by conservative methods.

Patients receive 50,000 units of penicillin every four hours for one week before surgery Streptomycin, 1 Gm. each day, is started two days before surgery and 6 Gm. sulfadiazine is given one day before surgery A gentle en ema is given the night before operation and an indwelling catheter inserted before surgery

The most satisfactory anesthetic is a combination of Baird's solution and nitrous oxide It helps counteract hy potension and the patient is easily moved.

TECHNIC.—The incision extends from the symphysis pubis parallel to the inguinal ligament to a point 2 cm. superior to the anterior superior iliac spine. Anterior dissection is accomplished through this incision (Fig 185) The incision is then curved posteriorly and inferiorly overriding the greater trochanter and extending along the infragluteal fold to the symphysis pubis. Poupart's ligament is di vided and the inferior insertion of the rectus abdominis severed. The peritoneum is separated from the iliac fossa, and the spermatic cord, bladder and rectum are retracted. The ureter is identified, and the external iliac artery and vein are clamped, cut and doubly ligated. The crest of the ilium and the sacroiliac synchondrosis are exposed. The symphysis pubis and sacroiliac synchondrosis are transected with a Gigli saw

(6) Ann. Surg. 130:76-99 July 1949

The patient is turned to the uninvolved side and the posterior dissection started Gluteal muscles and sacrotuberous, iliolumbar and sacrospinalis ligaments are severed. The gluteal and obturator vessels are ligated Nerves of the lumbar and sacral plexus are transected but no injected The sciatic nerve is severed last.

Postoperatively, a rectal tube, tidal bladder drainage, antibiotics and a Levin tube may be necessary Early ambulation is encouraged Complications after surgery include

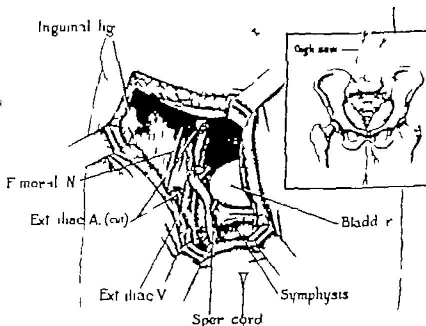


Fig. 186 —Anterior dissection Incision extending from symphysis pubis to 2 cm. superior to anterior superior spine of ileum has been deepened. Inguinal ligament severed at its attachments and external iliac artery ligated and clamped. After retraction of spermatic cord structures and bladder external iliac vein will be ligated and divided crest of ilium and sacroiliac synchondrosis ak letontard by dividing overlying muscles and innominate bone disarticulated (insert) (Courtesy of Ariel, I. M., and Hark, F W Ann. Surg 130 74 99 July 1949)

genitourinary and gastrointestinal difficulties, phantom limb herniation, wound separation and infections.

Four of the eight patients died One had bilateral pulmonary metastases and the other three were free from disease 2 12 and 15 months after surgery Bulky benign lesions such as chondromas, osteochondromas and neurofibromas have the best prognosis

Transmetatarsal Amputation for Infection or Gangrene in Patients with Diabetes Mellitus Leland S McKittrick, John

B McKittrick and Thomas S Risley[7] (Boston) used this procedure in 215 patients because removal of a toe, especially the great toe with its metatarsal head, alters weight bearing and increases vulnerability of the remaining toes Indications for transmetatarsal amputation include (1) gangrene of all or part of one or more toes, if the gangrene and accompanying infection have become stabilized and the gangrene does not involve the dorsal or plantar aspect of the foot, (2) a stabilized infection or open wound involving the distal portion of the foot when total excision with primary or delayed closure can be accomplished, (3) an open, infected lesion in a neurogenic foot as a curative procedure when the entire area of anesthesia can be excised, or as a delaying procedure when the area of infection can be excised but the line of incision is through the area of anesthesia

In a patient with borderline circulation, selection of a proper time for operation is one of the most important factors favoring a successful outcome No way is known to determine accurately whether or not transmetatarsal amputation will be successful in a foot in which arterial blood supply is deficient. The operation should be performed after gangrene and infection are demarcated Patients entering the hospital with severe pain will benefit from conservative treatment *for about three weeks*

METHOD—Patients are given 300 000 units of penicillin once or twice a day if infection is associated with gangrene When infection is under control, penicillin is stopped Buerger exercises are started and continued about two weeks. During this period the patient's general condition is supported with blood transfusions, adjustment of diabetes and other indicated procedures. During the 24 hours before operation, the patient is given 600 000 units of procaine penicillin G, which is continued postoperatively for 4 days.

After low spinal anesthesia is established, decisive incisions are made with a sharp knife. The dorsal flap incision is made directly down to the bone without undermining or dissection Plantar flap dissection is kept close to the underlying bone Each metatarsus is divided just proximal to its head with bone forceps, and all sesamoid bones are removed. No special attention is given to the tendons. Careful hemostasis with minimal trauma is essential. Closure is carried out in one layer using no 38 stainless steel wire starting from each end to insure accurate approximation of the two vulnerable

(7) Ann. Surg 130 826-84 October 1949

areas. There must be no tension on the suture line, nor should flaps be redundant. The wound is not drained

Both pre- and postoperatively the head of the bed should be elevated so that the patient's heart is always at a slightly higher level than the distal portion of his feet. Patients are kept in bed for about 2 2½ weeks after amputation Half of the stitches are removed after about nine days, and the remainder three to five days later Postoperatively, Buerger exercises are started after 10-15 days and mobilization is begun gradually, starting with 1 minute three times a day Average postoperative stay was 30 days.

Healing was complete in 155 of the 215 patients at the time of discharge Reamputation was done at a higher level in 27 patients, with prompt healing in all but 1, and 33 patients left the hospital with wounds incompletely healed. There were two hospital deaths

In 202 patients, follow up periods averaged 24 months. Failures, including the two deaths occurred in 17 per cent. In 16 per cent there was limited use of the legs but one or more of various local symptoms. The remaining 67 per cent had satisfactory results. The stump fully met the daily requirements of all patients (average age 61.5 years) With few exceptions, patients were discharged without a special type of shoe, although the toe of the shoe was filled with lamb's wool to lessen the tendency of the shortened foot to slip forward

Experimental Tendon Repair within Flexor Tunnels Use of Polyethylene Tubes for Improvement of Functional Results in the Dog Richard L Gonzales[8] (Univ of Colorado) recalls that severance of flexor tendons in the proximal two thirds of a finger and distal inch in the palm not only is the commonest tendon injury but attempts at repair are followed by the poorest results The anatomy of the flexor mechanism of the dog's forefoot is essentially the same as that in the human hand and presents a situation ideal for well controlled experiment A quantitative method for determining strength and a system of grading function from 0 to 3 plus after primary tendon repair within the flexor tunnels was developed Primary tendon repair using scrupulous asepsis, bloodless field, atraumatic technic and plaster cast immobilization was accomplished by using Bunnell's removable tension wire a single (basket weave) suture

(8) Surgery 26 161 198 August, 1949

anastomosis and experimental tubes to block extratendon tissues For every procedure there was a control.

In the search for an experimental membrane suitable for use in the block technic, polyethylene film proved particularly adaptable for the work. Because of its low melting point (110 C) it was possible to make single layer tubes of 0 003 in. thin film by folding the film and heat sealing the open edges. The tubes thus formed were exceptionally pliable and durable and were used about primary repairs. In secondary repairs after primary healing but when adhesions caused loss of function, a tube was constructed at the time of operation by encircling the freed tendon with a single layer of film and heat sealing the clamped free edges Thirty tubes were used about tendons, no gross or microscopic reaction to the material was ever noted.

In 25 cases of primary repair the tubes were left in place for 12 79 days No tendon healed before 29 days, then strength of union increased rapidly Average tensile strength of polyethylene tendons immobilized 40 days or longer was 785 Gm./sq mm., whereas the average for control tendon was 624 Gm Thus flexor tendons in the dog do heal if blocked away from their extratendon tissues, but healing is delayed The functional results in 25 experimental and 25 control tendons were carefully graded 14 of 16 polyethylene tendons achieved a rating of 2 or 3 plus whereas no control tendon was rated better than 1 plus This suggests that function is greatly improved if the suture line is blocked away from the extratendon tissues by a polyethylene tube

It was noted that the operative area in tendons immobilized less than 35 days was a solid mass of scar tissue, but after longer periods of immobilization the structures were clearly differentiated and adhesions were filmy and translucent, making it easy to dissect the tendons from the extratendon tissues In the controls it was impossible to demonstrate free gliding of the tendons Another point is the possible use of polyethylene film about tendons that have healed primarily but are bound down by adhesions After the adhesions are dissected away film could be wrapped about the tendon to prevent infiltration of adhesions, as demonstrated in five other dogs.

Interdigital Pilonidal Sinus In four years, E S J King[9] (Melbourne) has seen several of these cases in barbers and reports four, of which the following is typical.

Man, 42, had an abscess in the web between the middle and ring fingers of the left hand for three days He had had a similar condition two years previously, treated by incision He said that several of his fellow barbers had the same condition. There were red, tender



Fig 186—Index and middle fingers, showing pus small hairs embedded in skin, particularly in region just dorsal to web margin (Courtesy of King E. S J Australian & New Zealand J Surg 19 29 33 August, 1949)

thickening of the web a small shallow pit in the skin just dorsal to the web and a pale linear scar over the most prominent part of the swelling Incision of the swelling allowed a small amount of pus to escape and subsequent resolution Some minute pieces of hair were found embedded in the skin of the index and middle fingers, particularly in the web (Fig 186) they had cut ends without root

These cases clearly result from the special circumstances of the men's work. At work hairs are seen to accumulate between the fingers, appearing almost to flow toward the

(9) Australian & New Zealand J Surg 19 29-33 August, 1949

interdigital spaces Once even a small depression is formed, the hairs in the region find their way into it Some hairs which become embedded in the skin give rise to infection, and thus a small opening in the skin begins If this is just behind the web, one or more hairs will enter it, perhaps only temporarily, but as the result of repeated insults the opening persists and becomes larger Epithelization of such a depression or pit is common Finally a well defined crypt or pit is formed from which usually a few hairs project. Pits of this kind are found in various parts of the body where folds of skin form a well defined crease or groove

From the features noted it is clear that the usual view regarding sinuses of this kind must be broadened. Several characteristics may be stated pilonidal sinuses are found in many areas, in none of these areas do they have a specific site, the site varying from case to case within the area, they occur at all ages, they develop under observation and in an area previously normal the hair in the sinus is extraneous and need not belong to the same person

The interdigital sinuses are obviously formed postnatally and there is no apparent embryologic basis for their develop ment in antenatal life Sacrococcygeal cysts exhibit all the features mentioned in this case the hairs come from the patient's back, and their entry into a forming or formed sinus can be prevented by application of an appropriate dressing Early stages of the developing crypt can be shown to be enlarged hair follicles The important point is that once the crypt begins to form the process will proceed in the manner described The various hypotheses relating them to developmental anomalies should be discarded

Ganglion Manfred Meyer[1] (Univ of Basel) states that ganglions occur relatively often and have a predilection for the extensor aspect of the wrist The pathogenesis, and particularly the histogenesis, of this condition is still open to question. The rupture and retention theories have been abandoned Remaining theories are that the ganglion is a neoplastic formation or the product of degeneration. Meyer presents six cases including one of carpal and one of tarsal ganglion and four of meniscal ganglion of the knee

(1) Helvet chi acta 155-160 1936

Histologic examination of the specimens showed that the tissue of the ganglion is at first filled with several cavities of varying sizes Each cavity has a network of threadlike, coagulated substance in which are scattered fibroblasts. The cavity wall consists of a layer of taut, collagenous connective tissue In the septa between the larger cavities a change occurs The collagenous fibers split up at their extremities and seem to dissolve, in that they lose their staining capacity and finally disappear A weak metachromasia is evident in some places In others there seems to be stratification of the collagenous connective tissue This change results in flattening of the cells, which gives the cavity wall the appearance of being covered by a fine epithelium However, there is never a true epithelium There is a slight degree of vascular neoformation, and no inflammatory cells are present.

These observations suggest that the ganglions originate on the basis of a degenerative phenomenon of mucous colloidal nature This concept is also supported by the fact that with silver impregnation the softest fibers are stained dark brown or black. The whole histologic picture militates against the tumor theory

ANESTHESIA

Edited by

STUART C. CULLEN M.D

REGIONAL ANESTHESIA

Changes in Renal Circulation and Function during Temporary Denervation. James L Southworth[1] (Baltimore) induced extradural anesthesia from the sixth thoracic through the third lumbar nerve roots by introducing 1.5 per cent metycaine* into the extradural space In normal patients *the glomerular filtration, renal blood flow and filtration* fractions varied only about 5 per cent from control values. Renal resistance fell 23 per cent. In 27 patients with hypertensive vascular disease there was a 12 per cent decrease in glomerular filtration rate, 10 per cent increase in renal blood flow, 15 per cent decrease in filtration fraction and 16 per cent decrease in renal resistance These data indicate that in both the normal and the hypertensive state nerve block of the renal and splanchnic areas and lower extremities may result in changes consistent with renal vasodilatation. In no instance was renal hyperemia or real increase in filtration observed. Whereas the data do not support the concept that renal function may be improved by extradural anesthesia, there is no evidence to indicate that it is harmful. If renal vasoconstriction causes renal insufficiency, nerve block methods may be of value in treatment.

Continuous Lumbar Paravertebral Sympathetic Block Maintained by Fractional Instillation of Procaine Using this method, James R. Thomason and William H. Moretz[2] (Univ of Utah) obtained therapeutic interruption of sympathetic impulses without complications in 15 patients. The block was maintained by intermittent injections of procaine

(1) Anesth. & Analg. 28 279-283, Sept.-Oct., 1949
(2) Surg., Gynec. & Obst. 89 447-453 October 1949

hydrochloride, making it unnecessary to perform repeated blocks Such prolonged observation makes possible a more thorough evaluation of the need for surgical sympathectomy

METHOD—The equipment is that used for a continuous spinal anesthetic. With the patient lying on the side opposite that of the injection site, a no 16 Tuohy needle with a Huber directional point is inserted according to the technic of Labat just beneath the transverse process of the second lumbar vertebra The directional point is toward the midline A no 3½ Tuohy catheter is inserted through the lumen of the needle until it reaches the distal end. With the catheter held in place with one hand the needle is removed by sliding it off the catheter with the free hand. A blunt pointed no. 23 needle is inserted into the free end of the catheter and procaine injected through the catheter into the site of the lumbar sympathetic chain Each injection should consist of 8 cc. of 1 per cent procaine mixed with 30 000 units of penicillin, the latter to prevent infection around the catheter Between injections the needle is closed with a sterile metal plug and, with the catheter attached placed in a sterile test tube, which is closed with a sterile cotton stopper An abdominal pad is placed over the catheter, and pad and test tube are fixed to the patient's side with adhesive

By diffusion the procaine comes in contact with the second and third lumbar ganglions and frequently reaches the first lumbar ganglion. The patients treated had such conditions as acute thrombophlebitis, cellulitis associated with pain, acute arterial deficiency arteriosclerosis associated with vasospasm, causalgia, painful neuroma phantom limb and stump pain Relief was subjective, objective or both in all but one.

Brachial Plexus Block Simplified Technic Using Axillary Route is described by Nick J Accardo and John Adriani[3] (Louisiana State Univ)

METHOD—With the patient supine the arm is abducted at 90 degrees and allowed to rest on a support in external rotation. The field is surgically prepared and draped. The insertions of the latissimus dorsi posteriorly and pectoralis major muscle anteriorly are palpated and a vertical line is drawn between them. This line is then bisected and the point marked. This point lies directly over the brachial artery which is easily palpated even in obese subjects. A wheal is raised at this point with 2 per cent procaine. A 25 gauge needle of suitable length is attached to a 10 cc. syringe. The axillary artery is palpated and retracted posteriorly with the thumb and index finger to remove it from the path of the needle. The median nerve is then easily palpable along the artery The needle is introduced directly perpendicular to the skin and to the humerus toward

(3) South M J 42 920-922 October 1949

the median nerve Paresthesias are sought to the finger tips and 5 cc. of 2 per cent procaine is introduced at this point (Fig 187) The needle is then withdrawn almost to the skin and reintroduced at an angle 45 degrees anterior to the direction of the first injection The point will be directed toward the insertion of the pectoralis major muscle, where the musculocutaneous nerve is invariably close to the artery Paresthesias should be sought to the elbow and 5 cc. of 2 per cent procaine introduced (Fig 187) The needle is then withdrawn almost to the skin, the artery retracted anteriorly toward the upper surface of the arm and the ulnar nerve palpated on the under

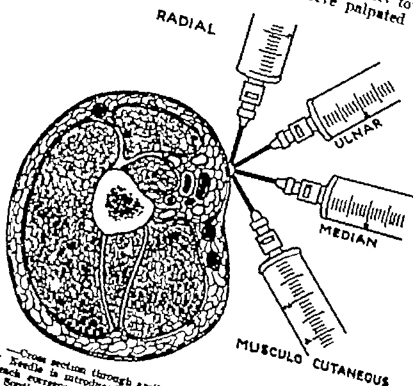


Fig. 18 —Cross section through axilla at level of insertion of pectoralis major and teres major Needle is introduced perpendicularly to humerus and inclined at various angles to reach corresponding elements of plexus. (Courtesy of Accardo, E J., and Adriani, J : South. M. J 42-920-921 October 1949)

surface The needle is directed posteriorly and downward at an angle of 45 degrees to the line of the original injection for the median nerve. Paresthesias corresponding to the distribution of the ulnar nerve to the fourth and fifth digits are sought and 5 cc. of 2 per cent procaine is injected (Fig 187) The radial nerve is least accessible but is found by keeping the artery retracted upward and re introducing the needle at an angle of almost 90 degrees with the direction of the first injection. Paresthesias corresponding to the distribution of the radial nerve along the back of the hand must be sought before 5 cc of 2 per cent procaine is injected at the site,

(Fig 187) The syringe should remain attached to the needle throughout all maneuvers. The needle must always be at right angles to the long axis of the humerus. Aspiration must be attempted before each injection After injection the site is massaged gently for five minutes. Epinephrine 1 100,000 may be used for prolonged anesthesia.

The full effect of anesthesia is established in 15 minutes and may last as long as two hours but usually averages one hour The block was easily taught and was successfully used by 14 anesthetists. It is superior to the supraclavicular approach because puncture of the pleura is impossible In the supraclavicular approach, the drug does not reach all the elements of the plexus which are farther apart in the supraclavicular region than in the axilla, resulting in partial or incomplete anesthesia. By using a small needle for the axillary puncture it is difficult to pierce the artery Block may be repeated if the operation outlasts the anesthesia because the site of injection is removed from the operative field and is relatively small. This block is suitable for the relief of vasospasm and other conditions requiring sympathetic block.

MUSCLE RELAXANTS

Evaluation of Curarizing Drugs in Man Potency, Duration of Action, and Effects on Vital Capacity of D-Tubocurarine, Dimethyl D Tubocurarine, and Decamethylene-Bis (Trimethylammonium Bromide) K. R. Unna, E W Pelikan D W Macfarlane R. J Cazort, M. S Sadove J T Nelson and A. P Drucker[4] (Univ of Illinois) made quantitative comparative studies in 75 experiments on four unanesthetized normal subjects Dosage was calculated to produce 95 per cent paralysis of the grip strength (GD_{95}) Effects of a given dose of d tubocurarine or dimethyl-d tubocurarine were predictable with greater accuracy than those of C-10 (decamethylene-bis) Dosage effects were manifest 45 seconds after beginning injection and became maximal 4-6 minutes after injection. With the doses used cumulative effects were not noted with any of the drugs.

(4) J Pharmacol. & Exper Therap. 98 318-329 March, 1950

The table shows the significant differences in potency of the three agents. D tubocurarine was about one fifth as potent as C-10 and two-fifths as potent as dimethyl-d tubocurarine Coefficients of variation supported the impression that response with a given dose of C-10 was less predictable than responses to a given dose of the other agents

In all experiments the course of recovery was remarkably smooth. C-10 effect persisted less than 20 minutes, dimethyl d tubocurarine, 21 26 minutes, and d tubocurarine 27 minutes or longer in most experiments Dimethyl-d tubocurarine depressed vital capacity less than 20 per cent, d tubocurarine depressed it 21-40 per cent and C-10 41 per cent or more None of the drugs altered the function of the intrinsic (nonstriated) muscles of the eye The moderate ocular paralysis and its late maximum with either of the first two agents contrasted with the striking degree of paralysis and early appearance with C-10 With d tubocurarine, recovery of ocular muscles paralleled and with dimethyl-d tubocurarine slightly preceded recovery of grip strength, after C-10 ocular motility returned almost completely while paralysis of the grip was almost maximal.

EQUIPOTENT DOSES (GD_{95}) OF D-TUBOCURARINE, DIMETHYL-D-TUBOCURARINE AND C-10 EXPRESSED AS MICROGRAM ION/KG. BODY WEIGHT

SUBJECT	WEIGHT KG.	D-TUBOCURARINE		DIMETHYL-D-TUBOCURARINE		C-10	
		GD_{95}	No. Exper	GD_{95}	No. Exper	GD_{95}	No. Exper
DW	68.2	105	8	40	5	23	12
MS	81.9	99	8	40	6	18	6
RC	70.5	121	6	43	6	23	6
JN	86.4	105	6			16	6
Mean GD_{95}		107 ± 9		41 ± 2		20 ± 4	
Coeff. of Var		8.4%		4.9%		20.0%	
Total Exper			28		17		30

Action of D Tubocurarine Chloride on Central Nervous System of Cat has been studied by S Salama and Samson Wright[5] (Middlesex Hosp Med. School, London) In most experiments cats anesthetized with chloralose were used,

(5) Brit. J Pharmacol. 5 49-61 March 1950

but no qualitative differences resulted when decerebrate cats were studied.

Intraventricular or intracisternal injection of 0.1-0.2 mg/kg d tubocurarine chloride was followed in less than one minute by heightened reflex excitability. In less than four minutes seemingly spontaneous movements and alterations in muscle tone occurred followed by strong convulsive movements which first affected the head and forelimbs and subsequently spread to the hind limbs. Convulsive movements varied markedly in frequency and in some cases recurred every second. The state of hyperreflexia, including convulsions, persisted for more than an hour. Immediately after injection there was a rapid striking rise in blood pressure from 110 to 220 mm. Hg which frequently persisted for 15 minutes but usually attained its initial level in about an hour. Within one minute of injection there was pronounced augmentation of both rate and depth of respiration. Respiration stimulation and blood pressure elevation occurred at the same time and preceded onset of convulsions. After intraventricular injection, pupils gradually increased in size until maximal dilatation occurred. The lids were powerfully retracted and the eyeballs fixed. When the drug was injected intracisternally the eye changes either did not appear at all or developed slowly. Salivation and excessive lacrimal secretion almost always followed injections of d tubocurarine.

When injected intrathecally the drug primarily has access to spinal cord centers only. Secondarily it flows upward in the subarachnoid space and ultimately reaches supraspinal levels where it will produce the same type of effect as with intracisternal or intraventricular injection though to a less extent because smaller concentrations of the drug reach these higher levels.

When tubocurarine was injected intrathecally below a ligature tied tightly around the dura in the midthoracic region so as to occlude the subarachnoid space without impairing nerve conduction in the spinal cord, action was limited to the distal part of the cord. The latent period before onset of increased reflex excitability was decidedly longer and the minimal effective dose about three times greater than when injection was given with the subarachnoid

space unobstructed Intraventricular injection in this preparation produced the same heightening of reflex excitability in the distal cord as in animals with the subarachnoid space unoccluded When the ligature was tied so as to abolish transmission of all nerve impulses in the cord and block the flow of cerebrospinal fluid, injection of the drug caused no changes in the circulation, respiration or eyes and only after well over one hour did convulsive movements of the hind limbs appear Typical changes were produced above the level of transection after intraventricular injection of tubocurarine

The observations suggest that d tubocurarine chloride has a direct and *striking excitatory action on the central* nervous system The effects are mainly the result of stimulation of the cells of origin of facilitatory pathways in the brain.

Flaxedil as a Curarizing Agent in Anesthesia Howard Bruce Wilson and Helen E Gordon[6] (Royal Aberdeen Hosp for Sick Children) report satisfactory results with flaxedil or tri (diethylamino-ethoxy) benzene triethiodide, an agent which acts at the myoneural junction by interfering with the chemical mediator in a fashion similar to d tubocurarine Its effects are easily and rapidly reversed by neostigmine

Method.—Premedication with omnopon® and atropine was given in doses according to body weight and followed by thiopentone soluble and nitrous oxide and oxygen. Anesthesia was maintained in either deep first or light second plane. All patients were intubated with an oral Magill tube lubricated with nupercaine® paste so that it would be well tolerated at the light plane of anesthesia. Flaxedil was administered just as the surgeon reached the peritoneum, and additional doses were given when required. Care was taken to give the last dose at least 30 minutes before the end of the operation, otherwise the patient would have an inefficient peripheral respiratory mechanism and it would be unsafe to rely on ordinary post operative ward care

All but 12 adults in the authors' series of 60 children and 20 adults underwent laparotomy, intrathoracic procedures such as pneumonectomy or lobectomy were done on the 12 Flaxedil, 120 mg., given intravenously had clinical effects comparable to a 15 mg dose of d tubocurarine chloride Relaxation began 60-90 *seconds* after intravenous injection

(6) Lancet 2 501 503 Sept. 17 1949

reached a peak in 120 seconds, persisted for 20-25 minutes and wore off gradually Satisfactory abdominal relaxation was never achieved without some intercostal paralysis. Lobar collapse occurred in two children early in the series *and was attributed to late administration of flaxedil* and return to the wards with some intercostal paralysis still present. In no patient returned to the ward with full inter costal activity did any chest complication develop There was no fall in blood pressure and no evidence of excessive release of histamine Collapse or distention of the intestine did not occur during operation No venous thromboses were noted, and no abnormal constituents were found in the urine Postoperative sickness was minimal but sedation was required earlier because of rapid recovery from the light plane of anesthesia

Massive Pulmonary Collapse Following Anesthesia with Curare in a patient with partial intestinal obstruction is reported by R Foregger H. Rettig and Conde Conroy[7] (Milwaukee)

An obese, hypertensive woman, 58, ceased breathing three minutes after 8 cc. curare (intocostrin*) was given at the beginning of the operation There were slight increases in pulse rate and blood pressure at first. On the assumption that cessation of respiration was only temporary, artificial ventilation with pure oxygen was carried out. The operation lasted 1½ hours and consisted of liberation of adherent bowel loops and repair of hernial defects in the abdomen. At the end of the operation 1 cc. prostigmin* was given. The respirations did not return. Color was good, the pulse 84 and of good *volume and blood pressure 100/90*

For the next two hours futile attempts to initiate respiration included use of 5 cc. coramine,* rectal dilation, change of position, sudden increased concentration of ether and then of carbon dioxide and 1 cc. metrazol.* Repeated aspiration thru the endotracheal tube had yielded no mucus. When tracheal rales appeared, use of epinephrine, 1 cc. was followed by disappearance of rales and less *difficulty in inflating the chest Supportive intravenous therapy* consisted of 5 per cent glucose in saline, 1,000 cc., then plasma, 1 000 cc., over eight hours starting at the beginning of operation. Blood pressure gradually began to drop 5½ hours after curare had been given and the pulse became weaker Epinephrine, 1 cc., was given on two occasions with only temporary rise in blood pressure, and the patient died eight hours after cessation of spontaneous respiration. *Autopsy within an hour of death revealed massive* bilateral atelectasis.

(7) Wisconsin M J 48 1004 1006 November 1949

Possible mechanisms unfavorably considered the cause of death are (1) myasthenia gravis contraindicating use of curare in anesthesia, (2) prolonged use of high concentration of oxygen for artificial respiration (3) rupture of the visceral pleura from vigorous efforts of artificial respiration. The most probable mechanism is that curare liberates histamine in the tissues. Histamine produces bronchoconstriction with subsequent pulmonary collapse as has been observed in animals and in man.

The authors suggest the possibility of abolishing the bronchoconstriction by intravenous administration of an antihistamine such as pyribenzamine● or benadryl● or by deepening the level of anesthesia

On Pharmacology of Myanesin,● with Particular Reference to Its Intramuscular Administration. The new synthetic relaxing agent, α β dihydroxy-γ (2-methylphenoxy) propane (myanesin●) may cause hemolysis vasodepression, cardiotoxicity or respiratory paralysis, but because it may have a useful role in anesthesia J B Wyngaarden, H L Tieche and M. H. Seevers[8] (Univ of Michigan) investigated some of its pharmacologic properties more fully In dogs relaxation and sedation could be obtained by intramuscular administration of myanesin● although larger doses were required than those producing similar effects intravenously Intramuscularly, the drug could be used in doses up to 25 mg/kg dissolved in 40 per cent propylene glycol or up to 50 mg/kg or more if dissolved in 10 per cent urea and 8 per cent propylene glycol, without producing any detectable hemolysis Further experiments using dogs anesthetized with thiobarbiturates indicated that if myanesin● is used to enhance relaxation and to prevent the stimulating effect of intravenous anesthesia the quantity of barbiturate required would be reduced and a lighter plane of anesthesia would suffice As a solvent vehicle for 10 per cent myanesin● 40 per cent propylene glycol causes slightly more hemolysis and more irritation in intramuscular injection than does 10 per cent urea and 8 per cent propylene glycol but does not produce local edema as does the urea vehicle

Since many of the characteristics of benzimidazole a

(8) Anesthesiology 10 5 9 543 September 1949

skeletal muscle relaxant, resemble those of myanesin,* the possibility of synergism and potentiation when the two compounds are administered simultaneously was considered Experiments with mice showed additive effects only

The role of the liver in detoxication of myanesin* was studied in mice that had been given carbon tetrachloride Liver damage induced in this manner shortened the latent period of action of myanesin* by 41 7 per cent and increased its duration of action 480 3 per cent The results strongly suggest that detoxication is a function of the liver An earlier accumulation of the necessary level of myanesin* to produce paralysis may account for the decreased latent period in such animals Impaired destruction probably accounts for the increased duration of action.

[In general this preparation has been almost abandoned as a clinical muscle relaxant during anesthesia because of the undesirable features indicated in the article and because other more satisfactory preparations have been developed.—Ed.]

Relative Susceptibility of Diaphragm, as Compared with Limb Muscles, to Effects of Tubocurarine Chloride was investigated by J D P Graham and R. St. A. Heathcote[9] Using cats or rabbits, direct recordings were made of the effects of tubocurarine chloride on the contractions of the diaphragm and voluntary muscle The diaphragm was more resistant to the drug than was limb muscle under exactly similar conditions This was true whether both muscles received their stimulus in the form of faradic currents applied to the motor nerve or the limb muscle received such stimulation while the diaphragm responded to normal stimulation. The difference in susceptibility was of the order 4 5

Responses of muscles stimulated either through the motor nerve or by a reflex are reduced by tubocurarine but the reflex is more rapidly affected Therefore, the diaphragm should be capable of carrying on its necessary movement when reflex phenomena are abolished.

The therapeutic index of tubocurarine the ratio of the dose required to arrest respiration to that needed to abolish muscle tone is 1 4.

Use of Decamethonium Bromide for Production of Muscular Relaxation Leroy C Harris, Jr., and Robert D Dripps[1]

(9) Brit. J Anaesth. 22 17 24 January 1950
(1) Anesthesiology 11 218-223 March 1950

(Univ of Pennsylvania) have used this drug in 199 females and 51 males, aged 12-85 most of whom had intra abdominal operations For lower abdominal procedures, 2-3 mg was usually given initially, and for upper abdominal procedures, 3-4 mg Maintenance doses of 1-3 mg were given when additional relaxation was required Total dose varied from 2 to 3 mg for an appendectomy to 20 mg for a gastric resection. Onset of action was rapid, the effect reaching a maximum within 3 or 4 minutes, wearing off in 8-10 minutes and completely disappearing in 20-30 minutes. No drugs which inhibit cholinesterase were of value as antagonists for decamethonium bromide

When the drug was used in amounts sufficient to cause adequate relaxation of abdominal muscle there was definite respiratory depression which was directly related to the size of the dose When doses were in the range of 1 2 mg., there was a consistent increase in the respiratory rate Pro longed respiratory depression occurred in four patients The drug had no deleterious effects on the circulation, even in doses sufficient to cause respiratory paralysis and com plete muscular flaccidity

Fair to excellent muscle relaxation was achieved in all but two patients and was similar to that obtained with comparable doses of curare

Endotracheal intubation appeared easier with 4-5 mg decamethonium bromide and 300-400 mg pentothal® injected rapidly over 15-60 seconds than with pentothal®-curare com binations The effects of decamethonium bromide with the common anesthetic agents were additive, no instances of synergistic action being found. In most cases the drug did not prolong the period of recovery from general anesthesia No instances of bronchoconstriction or sudden fall of blood pressure due to the drug occurred in this series The out standing pharmacologic advantage of this agent is the apparent absence of histamine like effects

Clinical Impressions of Decamethonium Bromide (C10) in Anesthesia Preliminary Report is made by C Herbert Spencer and Charles S Coakley[2] (George Washington Univ) who used it in common abdominal operations or to facilitate endotracheal intubation in 100 cases under general anesthesia

( ) M Ann District of Columbia 19:122-125 March, 1950

METHOD.—An initial injection of 2 mg decamethonium bromide was followed at intervals by doses of 0.5-1 mg In a second method doses ranging from 0.5-1.0 mg were given at the beginning of operation and followed by smaller doses at 10-20 minute intervals. The average amount was 2.0 mg Oropharyngeal airways were used in all cases which did not require endotracheal intubation.

With the initial dose of 2 mg., curare like effects could be noted in two to three minutes and reached a peak in five minutes Abdominal relaxation persisted 15-30 minutes before a second dose was necessary With repeated small doses these effects were slower in onset, and relaxation was not so profound In all but two patients the quality of relaxation was good For closure of abdominal wounds, 0 5-1.5 mg usually sufficed

The respiratory effects were similar to those seen with d tubocurarine but decamethonium bromide is probably less likely to cause bronchospasm, making it desirable for use with pentothal* sodium or cyclopropane Some degree of respiratory depression was noted in almost all cases when relaxation was adequate but occurred more suddenly and lasted a shorter time than when d tubocurarine was used. Complete apnea occurred in 20 patients and 18 showed severe respiratory depression, but only 1 required controlled respiration for over 20 minutes Apnea developed in 30 per cent of those receiving barbiturate gas-ether anesthesia but in only 9 per cent in the barbiturate-gas group No bronchial or laryngeal spasms were encountered

Cardiovascular changes appeared in only two patients and were probably associated with operative procedures rather than with the relaxant postoperative complications were minimal.

Use of Bis-Trimethylammonium Decane Dibromide in Anesthesia. This agent C-10 has been used to enhance muscle relaxation, suppress coughing aggravated by endotracheal tubes relieve laryngospasm and facilitate endotracheal intubation by Duncan A. Holaday A. McGehee Harvey and David Grob[3] (Johns Hopkins Univ) in 172 patients undergoing major surgery

METHOD —C-10 is administered by intravenous injection of 1 2 mg of the dibromide salt in a solution containing 1 mg./cc., at a rate not exceeding 1 mg /minute, through the tubing used for ad

(3) New England J Med. 241 816-817 Nov 24 1949

ministering pentothal* or an intravenous infusion Doses of 0.5-1 mg may then be injected every 5-10 minutes as long as "curarization" is desired. If 20 minutes or longer has elapsed since the previous dose the initial dose may be repeated. Respiratory depression may follow administration of 1.5-2 mg in a single dose.

Satisfactory abdominal relaxation followed administration of C-10 during 130 abdominal operations, during 18 others only fair relaxation was obtained and in 10 relaxation was unsatisfactory Respiratory depression, usually manifested by a decrease in tidal volume and minute volume with no change or increase in the respiratory rate, was encountered in 94 patients In some cases the agent caused jerking spasm like contractions of the diaphragm. In 148 patients blood pressure and pulse rate did not fluctuate significantly after administration but in 18 in whom respiratory depression was permitted to occur broad alterations in cardiovascular activity did occur presumably secondary to partial asphyxia There was no obvious potentiation of the effect of C-10 by pentothal,* nitrous oxide, ether ethylene cyclopropane or spinal anesthesia There were no deaths There were no adverse respiratory or cardiovascular manifestations postoperatively

[The three preceding articles represent fairly the almost universal impression that this new muscle relaxant may be a satisfactory substitute for curare.—Ed.]

Quantitative Studies on Autonomic Actions of Curare have been made by Arthur C Guyton and Robert C Reeder[4] (Univ of Mississippi) In lightly anesthetized dogs complete paralysis of parasympathetic nerves to the iris and heart required 1½ times as much curare as was needed for skeletal nerve paralysis. Paralysis of iris, nictitating membrane and cardiac accelerator sympathetics required 5-10 times as much curare as did skeletal muscle paralysis. The splanchnic nerve mechanism was about five times less susceptible to curare than skeletal nerve endings of the gastrocnemius muscle With total paralysis of both ciliary and superior cervical ganglions, stimulation of postganglionic fibers still produced maximal contraction of the iris and nictitating membrane The duration of paralysis of these ganglions averaged 20 and 22 minutes respectively

Curare usually caused a moderate depressor effect on

(4) J Pharmacol. & Exper Therap 98 188 193 February 1950

blood pressure but with large doses the animals almost invariably went into shock. This can hardly be explained on the basis of sympathetic paralysis because of the relative resistance of sympathetics to the drug In small doses curare caused a mild increase in blood flow but as paralysis was achieved there was usually a decrease to levels considerably below normal.

[The ability of curare to block the response to acetylcholine has led to speculation on the effect of curare on synapses in which acetylcholine was the chemical mediator This article may help to elucidate some of the qualitative effects in this area.—Ed.]

LOCAL ANESTHETICS

Procaine and Autonomic Innervation. The mechanism of action of procaine on autonomic innervation has been studied by D Atanackovic and S Dalgaard Mikkelsen[5] (Univ of Ghent) on 24 dogs anesthetized with chloralosane. Small doses of procaine (10-40 mg /kg) given intravenously to 11 atropinized dogs decreased acetylcholine (60-240 gamma/kg) hyperpnea and changed the hypertensive effect to an arterial hypotension. The vasopressor reflexes of carotid sinus origin were unaltered. Procaine in doses of 40-300 mg /kg curarized first intercostal respiratory muscles, then the diaphragm and finally the skeletal muscles Bradycardia induced by vagus stimulation or by nicotine was suppressed. Acetylcholine in doses of 30-60 gamma/kg caused arterial hypotension without bradycardia, and higher doses induced bradycardia which was in turn suppressed by higher doses of procaine Vasopressor reflexes of carotid sinus origin or *induced by central vagus nerve stimulation* are first depressed and then blocked by high doses of procaine

Procaine in doses of 40-100 mg /kg protected against physostigmine (3 mg /kg) bradycardia, bronchospasm, salivation, muscular fasciculations and convulsions. Marked cholinergic reactions could still be induced by injection of acetylcholine After injection of doses of procaine which block heart vagus innervation, suppress the nicotinic and

(5) Proc. Soc. Exper Biol. & Med. 74 55-56 May 1950

muscarinic action of acetylcholine on the heart and the nicotinic action of acetylcholine on sympathetic vasomotor synapses, injection of physostigmine (0.3-0.5 mg./kg.) or diisopropyl fluorophosphate (5-10 mg./kg.) deblocked the heart vagus innervation and restored the muscarinic effects of acetylcholine on the heart and on the vasomotor synapses. After deblocking, paralyzing effects of procaine could be induced by injection of higher doses of the drug and in turn these effects could be deblocked by new injections of physostigmine or DFP.

Intravenous Administration of Procaine Hydrochloride during General Anesthesia. Ivan B. Taylor, Bert W. Marks and Gerald Edmonds[6] (Detroit) have combined intravenous procaine administration with three types of general anesthesia. The most frequently used method consisted of induction with pentothal,® with or without curare, usually followed by endotracheal intubation and a continuous flow of nitrous oxide and oxygen plus intravenous administration of procaine hydrochloride throughout the anesthesia. This combination was often used in thoracic surgery. The other anesthetic agents used with procaine were cyclopropane and ether.

METHOD.—About 500-1,000 cc. of 1 per cent procaine hydrochloride in 5 per cent dextrose solution is made by dissolving 1 Gm. sterile procaine hydrochloride crystals to each 100 cc. infusion fluid to be used. The crystals must be completely dissolved by thorough shaking. The solution is administered through a separate needle so that the rate can be carefully controlled. The rate is determined by counting the number of drops a minute, using an ordinary dropper in the intravenous tubing. Administration is usually started shortly after surgical anesthesia has been produced with the principal drug, the initial flow being at a rate of 30-60 drops/minute. This amounts to about 2-4 cc./minute or 20-40 mg. procaine hydrochloride/minute. When pentothal® is used for induction it may be necessary to increase the rate of flow as the pentothal® effect decreases. If there is a severe drop in blood pressure, regardless of cause, procaine flow must be stopped or decreased until the blood pressure has been corrected. During the operation, average rate of 2-4 Gm. procaine/hour is usually sufficient.

Among the desirable effects of procaine administration is depression of the cough reflex even when an endotracheal airway is in place or there is manipulation within the

(6) Arch. Surg. 59:714-723, September, 1949.

pleural cavity Procaine has been effective in preventing cardiac arrhythmias during most intrathoracic operations with cyclopropane It inhibits sweating, and the skin remains warm and dry Although this effect is for the most part desirable, during hot weather it may be undesirable. Respiratory secretions are greatly reduced, and excessive salivation, nausea, retching and vomiting postoperatively are rare Light anesthesia may be maintained with any anesthetic drug Postoperative analgesia is maintained from 20 minutes to several hours, thus making possible recovery to consciousness without excitement.

The greatest danger with intravenous use of procaine is circulatory depression, which may occur rather rapidly If pentothal[a] is being used circulatory depression may occur without convulsions With cyclopropane, the drop in blood pressure is rarely seen because convulsions usually precede circulatory depression It is best to limit the rate of flow to 4-5 cc/minute for an average adult and less for older patients Convulsions can be controlled either by intravenous administration of a barbiturate or by decreasing the rate of flow of procaine Other dangers such as damage to parenchymatous organs may occur but so far the authors have not encountered this complication.

Procaine has been found most advantageous in thoracic operations, thyroidectomy and operations of a superficial nature in which light anesthesia is adequate

[As can be seen from the article by Long *et al.* (p. 581) the use of procaine as recommended by Taylor in this article is particularly prone to serious trouble, and the technic outlined should be used only by those prepared to observe the patient constantly and closely—Ed.]

Treatment of Procaine "Hypersensitivity" with Neostigmine is described by I E Buff[7] (Charleston, W Va.) The symptoms of an overdose of procaine are variable but usually include confusion, laughter dizziness motor excitement, increased pulse rate and irregular respiration. Larger doses may cause sweating dilated pupils anxiety and paresthesia In 20 cases observed the most prominent symptom was a greatly increased pulse rate which developed with alarming rapidity

A dose of 0 5-1 mg neostigmine methylsulfate given subcutaneously or intravenously almost immediately reduced

(7) Am. Pract 1 347 348 April 1950

the cardiac rate to within normal limits Other symptoms were dramatically relieved in a short time The mechanism of action of neostigmine in these cases is unknown. The drug may possibly abolish supraventricular tachycardia through the medium of vagal stimulation.

Hexylcaine Hydrochloride Preliminary Report of Its Clinical Use in Comparison with Procaine is made by J Eugene Ruben and Elizabeth Anderson[8] (Philadelphia Gen'l Hosp) after using it as a spinal anesthetic in over 500 patients.

METHOD—For single dose spinal anesthesia, a 50 mg ampule of crystalline hexylcaine hydrochloride (1-cyclohexylamino-2-propyl benzoate hydrochloride) is dissolved in 2 ml. of 10 per cent glucose. The desired dose is drawn into a syringe and diluted with cerebrospinal fluid in sufficient amount to lower the glucose concentration to 5-7 per cent of the injected mixture Dosage ranges between 15 and 50 mg depending on site of operation and condition of patient. To minimize the dosage an attempt should be made to localize the injected anesthetic agent around the nerve roots supplying the area to be anesthetized by tilting the table slightly so that the solution flows in the desired direction. After three to five minutes, when anesthesia has reached the desired height, the table is leveled and preparation made for operation. For operations on the lower extremity the patient lies on the affected side until anesthesia is adequate usually three to five minutes, before being placed in position for operation

It has not been necessary to give more than 50 mg in a single dose of spinal anesthesia even for operations on the gallbladder and stomach. Ordinarily the total volume is 4 ml for surgery above the umbilicus and 1-3 ml. below this level

Intravenous vasopressor for spinal hypotension was required by 12 per cent of 100 patients in whom procaine was the spinal anesthetic agent whereas in the hexylcaine series 21 per cent required such medication. To complete the operation supplementary agents other than dilute pentothal® were used in 6 per cent of the procaine group and 2 per cent of the hexylcaine series In most cases the dose of hexylcaine was about one third that of procaine Several surgeons remarked on the completeness of abdominal muscle paralysis which spinal anesthesia with hexylcaine provides.

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(8) Am J Surg 78 843 846 December 1949

Hexylcaine was also used in 15 fractional spinal anesthetics with the catheter technic described by Touhy and the modification for segmental spinal anesthesia described by Saklad and co-workers

METHOD —The solution is prepared by dissolving 150 mg hexylcaine crystals in 6 ml. of 10 per cent glucose and diluting the mixture to a volume of 10 ml. with cerebrospinal fluid. Initially 15-30 mg hexylcaine is given and every 20-30 minutes after the first half hour an additional 15 mg may be given.

In this group the dosage of hexylcaine was considerably smaller than that of procaine in comparable operations in which fractional spinal anesthetics were used.

Hexylcaine has also been used in over 200 regional and local nerve blocks in concentrations varying from 0 25 to 1 per cent. It is apparently more effective in weaker concentrations than is procaine

To date no local or general toxic reactions to hexylcaine have occurred nor have there been irreversible changes in nerve function

Effect of Intravenous Procaine on Heart Joan H. Long Morton J Oppenheimer Mary R. Wester and Thomas M Durant[9] (Temple Univ) studied 20 mongrel dogs, utilizing the electrocardiograph Most animals were anesthetized with sodium pentobarbital, 35 mg /kg With a procaine dose of 4 mg /kg there was usually no change in the electrocardiogram heart sounds or blood pressure As the amount of procaine injected was increased to the fatal dose, varying from 20 to 80 mg /kg progressive changes occurred The changes were instituted more rapidly as the fatal dose was approached The T wave height was increased, flattened or inverted and then increased in height 10-30 seconds after injection of 8-10 mg./kg There was usually a lowering of the voltage of R often accompanied by an increase in the voltage of S At the dose of 20 mg /kg the first widening of the QRS complex was seen and thereafter widening increased with dosage There was an increase in the length of the P R interval with doses of 30 mg /kg At doses of 50-60 mg /kg a ventricular tachycardia occurred. All changes were reversible provided respiration was maintained When ventricular fibrillation occurred there was no

(9) Anesthesiology 10 406-416 July 1949

recovery even when artificial respiration was continued for a long period

There was some evidence that damaged cardiac muscle was more sensitive to procaine than was normal cardiac muscle In a dog in which portions of left and right ventricle had been removed three weeks before, ventricular fibrillation developed when 40 mg/kg was given. This was a dosage which had not produced ventricular fibrillation in 17 dogs with normal hearts At autopsy the hearts of all dogs which had died of overdoses of procaine were greatly dilated and the musculature appeared soft and flabby

The changes in respiratory rate were not intimately related to the cardiac changes. Doses up to 10 mg/kg increased the respiratory rate for about 30 seconds and larger doses decreased the rate Respiration usually ceased at doses of 40 mg/kg or more although the mechanical and electric events of the heart continued.

Electrocardiographic changes indicate changes in the rate of conduction of the cardiac impulse through the bundle of His and the ventricular muscle with lesser changes in the rate of conduction through the auriculoventricular node and perhaps through the atrial musculature QRS complex changes suggest that there may be a weakening of the force of the heart beat in addition to the change in conduction. Autopsy findings support the view that there is a direct effect of procaine on the cardiac musculature

If it is true that cardiac changes due to procaine may be manifest earlier and with smaller doses in abnormal hearts, its clinical usage for cardiac surgery and as an antidote for various arrhythmias and tachycardias which occur during anesthesia may require re-evaluation. Clinically on the basis of these observations there may be a fair chance of recovery following sudden collapse during the use of procaine if artificial respiration is instituted immediately

Xylocain Clinical Observations with a New Local Anesthetic Agent. G Neff[1] (Wallenstadt) recommends xylocain as a local anesthetic because of its rapid action and long lasting effect It is a tertiary amine and comes in sterile solution in strengths of 0.5 1 and 2 per cent. The formula

(1) Schweiz. med. Wchnschr 80 110 112 Feb. 4 1950

is 2 Gm diethylaminoaceto-2, 6-xylidihydrochloride, 0 00125 Gm epinephrine, 0 6 Gm. NaCl, 0 05 Gm. sodium pyrosulfite 0 1 Gm. methyl p-hydroxybenzoate, 100 Gm. aqua destillata

Xylocain is slightly more toxic than procaine in equal dosage but this is counterbalanced by the relatively small amount used. It does not cause local irritation, and it anesthetizes mucous membranes

Because of its prompt action and long effectiveness it is especially valuable in severe accident cases and in minor surgery Though it will not supplant procaine, it may prove useful in procedures which take considerable time

[There is some indication in the laboratory (not yet published) that the drug has a specific toxic effect on nerve tissue. This disadvantage has not been demonstrated in fairly extensive clinical use particularly in dentistry —Ed.]

Method for Topical Anesthesia by Nebulization of Local Anesthetics J B Miller F Mann and H. A. Abramson[2] (Sea View Hosp, Staten Island) state that inhalation of a nebulized surface anesthetic solution produces a profound surface anesthesia which extends from the external nares and mouth to the finest bronchioles This method overcomes all the defenses of the respiratory system without the disadvantages of the conventional procedures or their modifications.

Method —A DeVilbiss no 40 nebulizer is satisfactory because it delivers aerosol fairly rapidly, accommodates 8 cc. solution so that it will not spill into the patient's mouth and delivers most particles in a size range of 0.5-2 μ and 15-20 per cent of particles in a size range of 2-5 μ Oxygen or air may be used to nebulize the solution, a flow of 6-8 L./minute being satisfactory The mouthpiece of the nebulizer consists of a segment of rubber tubing 3 in long and ½ in. in diameter It is pushed about 1 in onto the oral end of the nebulizer and extends about 2 in. into the patient's mouth. Preferred anesthetic solutions are *0.5 per cent pontocaine® and 4 per cent* cocaine. To delay absorption 1 minim of 1 1,000 epinephrine/cc. solution may be added, but if cyclopropane anesthesia is to be used this is omitted. Nembutal® is usually given two hours before, and morphine and atropine one hour before, the procedure The patient is seated, his nose occluded by adhesive tape, and he is instructed to relax and simply breathe through the mouth. While the patient is inhaling the aerosol he is prepared for the sensations of surface anesthesia by explanation that his tongue will become numb he will feel a lump in the throat and he will finally be unable to swallow

(2) Dis. of Chest 16 408-419 October 1949

During the first five minutes the tip of the nebulizer is allowed to point straight back to the uvula then the anterior faucial pillars are anesthetized by turning the nebulizer 30 degrees for five minutes to each side. For the second 15 minutes the patient holds the tongue forward with a gauze sponge, introduces the nebulizer tip as far back as possible and aims toward the larynx and pyriform sinuses for five minutes each. The entire procedure requires 30 minutes but only about 5 minutes of this period is necessary for supervision. If the patient is prone, his head is rotated to one side and the mouth piece introduced and manipulated as described. For children under age 4 or 5 the procedure is carried out with the child held on the lap of a nurse, the straight rubber tip of the nebulizer placed in the mouth as though administering a bottle feeding. This position provides a feeling of security and eliminates fear and apprehension.

Procedures performed with the aid of this technic included bronchography, bronchoscopy, bronchospirometry and endotracheal intubation. Most results were classified excellent and the remainder good. One of the greatest advantages is the absence of discomfort to the patient. No gagging, coughing or spitting is associated with the method. There are apparently no dangers though reactions may occur in children or hypersensitive patients as a result of sensitivity to the agent used.

Nebulized Cocaine as Anesthesia for Peroral Endoscopy was used satisfactorily in over 600 patients by H. Frederick Keiber and David H. Jones[3] (Veterans' Admin. Hosp., Bronx, N. Y.). The procedure was usually performed for laryngoscopy, bronchoscopy or esophagoscopy. It may be used to remove nasal polyps, as a preliminary for local tonsillectomy, to take biopsy specimens, to instil iodized oil for bronchograms or to facilitate endotracheal intubation. The ease of performing an endoscopic procedure with this type of anesthesia is proof of its value. Patients should be observed for symptoms and signs of cocaine allergy.

METHOD.—The patient is hospitalized one day before endoscopy is to be performed and is given a thorough physical examination. The endoscopist should visit the patient and alleviate any fears. A preoperative medication is given to insure a good night's rest. No food should be taken by mouth for six hours before surgery. Two hours and one hour before surgery 0.1 Gm. nembutal® is given. In addition 10-20 mg. morphine and either 0.4-0.6 mg. scopolamine for those under age 45 or atropine for those over 45 is given 35 minutes preoperatively. The patient is strapped in a chair in the endoscopic room, given a DeVilbiss no. 640 nebulizer containing 3 cc. of 4 per

(3) Ann. Otol. Rhin. & Laryng. 58 10 5 1041 December 1949

cent cocaine solution aerosolized with humidified oxygen, and permitted to anesthetize himself. The nebulizer should have a piece of wide rubber tubing 8 cm. long attached to the mouth end. Oxygen is released at the rate of 5 L./minute. During a 20 minute period routine checks are made and the nebulizer advanced gradually toward the epiglottis. For maximal anesthesia at a particular level, up to 1.0 cc. cocaine may be dropped on a cord or through the glottic chink. For esophagoscopy, the same supplement may be dropped into the pyriform fossae. There may be good mucous membrane anesthesia but resistance due to neck rigidity. Since the latter renders proper glottic visualization difficult, 5-8 mg. morphine in 5 cc. saline solution may be given intravenously. The total amount of cocaine administered by this method is 0.12 Gm., which is well below the minimal lethal intravenous dosage of 0.2 Gm.

Prevention of Procaine Convulsions by Presidon® and Sodium Pentobarbital. Joseph F. Migliarese, Edward C. Bauer and Lowell O. Randall[4] (Nutley, N. J.) state that presidon® (pyrithyldione, 3,3-diethyl-2,4-dioxotetrahydropyridine) is a relatively short acting hypnotic with a wide margin of safety. Its anticonvulsive properties and those of pentobarbital were tested in mice, guinea pigs, rabbits and dogs which had received convulsive doses of procaine subcutaneously. The hypnotic drugs were given intraperitoneally 10 minutes before subcutaneous administration of procaine. Toxic symptoms included excitability, nervousness, tachycardia, dyspnea, clonic convulsions and terminal respiratory failure.

In comparison with pentobarbital, presidon® is an effective anticonvulsant. The protective index for presidon® is higher than for pentobarbital in the four species. The dose of presidon® which protects mice from procaine convulsions is about one-fourth the hypnotic dose, but the protective and hypnotic doses of pentobarbital are almost identical. In the other species the protective dose of presidon® is about one-third the hypnotic dose, whereas the protective dose of pentobarbital is about one half the hypnotic dose.

(4) Proc. Soc. Exper. Biol. & Med. 73:53-55, Jan. 1950.

Physiology of Coronary Circulation. James E Eckenhoff's (Univ of Pennsylvania) states that a sudden fall in arterial blood pressure leads to an immediate decrease in coronary flow If the decreased flow is adequate for the altered metabolic needs of the myocardium, no harm is done but if the flow is inadequate, relative coronary insufficiency occurs. Blood pressure is not always elevated when there is an increase in cardiac oxygen demand. If the arteries are unable to change their internal diameter coronary insufficiency results from lack of oxygen. With either inadequate coronary flow or diameter symptoms of coronary occlusion and death can occur yet at autopsy the vessels may be patent and to the unsuspecting quite adequate The patient's reaction to a fall in blood pressure is the best guide to therapy Vasopressor drugs are not necessarily indicated in young persons when pronounced falls in blood pressure are not accompanied by signs of discomfort or distress. If there is pallor sweating dyspnea tachycardia or chest pain, attempts should be made to return the blood pressure to its former level. Vasopressor drugs should be given intravenously in small amounts so that the pressure will not spike to a high level to be followed by a subsequent depression.

Patients with hypertension, especially those without coronary arteriosclerosis, do not always show evidence of coronary insufficiency if the blood pressure is reduced. However, cerebral anoxia anuria or both may develop owing to diminished oxygen supply to the brain or kidneys There fore blood pressure must be maintained at or near hypertensive levels during anesthesia to prevent postanesthetic cerebral and renal complications A dilute intravenous infusion of a pressor drug may be needed throughout anesthesia for this purpose In the hypertensive patient with coronary sclerosis, blood pressure must be maintained to prevent coronary insufficiency External heat should not be applied in shock because vasodilatation of the skin and skeletal muscles may cause an undesirable reapportionment

(5) Anesthesiology 11 168-176 March, 1950

of cardiac output which could be detrimental to the heart.

Oxygen is of paramount importance in shock or prolonged hypotension, particularly if the myocardium is damaged. By supplying more oxygen, cardiac work will be reduced and permanent myocardial damage prevented or minimized.

If the coronary arteries are normal, ephedrine, methedrine* or neo-synephrine* may be used to increase coronary blood flow. Pitressin* should not be used because it causes coronary constriction. With coronary arteriosclerosis, a drug having primarily a pressor action with a minimum of cardiac effect should be used to increase coronary flow. In this condition vessels of the heart have partially or completely lost the ability to change vascular tone, and coronary blood flow is determined primarily by the arterial blood pressure. Neo-synephrine* or allied drugs must be given in small amounts to avoid spiking of the blood pressure. Epinephrine or ephedrine are undesirable because they stimulate cardiac work. With cardiac damage or decreased exercise tolerance the ideal drug is one which will increase coronary flow without increasing cardiac work or oxygen demand. Papaverine has been found best for this purpose in animals. Aminophylline and nikethamide are unsatisfactory. Nitroglycerin does not increase coronary flow consistently and much of its benefit may be derived from a decreased oxygen demand by the heart consequent on hypotension.

Cardiac Arrest during Anesthesia and Surgery. Claude S. Beck and H. J. Rand III[6] (Cleveland) emphasize that the emergency of cardiac arrest must be anticipated for proper methods of treatment cannot be improvised at the moment they are needed. Their resuscitation procedure consists of restoration of the oxygen system and of the heart beat.

Distribution of oxygen to the brain must be re-established within three to five minutes after the system has failed. The two components of the oxygen system are introduction of oxygen into the lungs and circulation of oxygen to the brain. One is of no use without the other. The best way to introduce oxygen into the lungs is by way of a tube inserted into the trachea through which oxygen from a bag is forced into the lungs. Oxygen is circulated by reaching the heart and emptying it by hand. These procedures must

(6) J. A. M. A. 141:1230-1233, Dec. 24, 1949.

be carried out without interruption. It is important that the lungs be well inflated and well deflated with each respiration

Restoration of the heart beat is neither difficult nor urgent because once the oxygen system has been restored time is not a factor When the heart stops beating it shows either ventricular standstill or ventricular fibrillation and the method for restoring the normal beat differs in each condition. An electrocardiogram will show which is present. When the heart is in ventricular standstill it may start by means of massage alone If not, epinephrine 0.5 cc of 1 1 000 dilution in 5 cc sodium chloride solution, is applied to the heart surface or injected into the right ventricular cavity If the heart is not diseased it will always start beating

For ventricular fibrillation 5 cc of 1 per cent solution procaine hydrochloride is used part of which is applied to the heart surface and the remainder injected into the right ventricular cavity An electrode is placed on each side of the heart and a shock of 110 volts and 1.5 amp sent through the heart It may be necessary to repeat the shock if the fibrillary movements persist After fibrillation has disappeared the heart is in standstill and the technic of massage and administration of epinephrine is used Defibrillation has been successfully accomplished in about 12 cases

After the heart beat has been restored and the chest incision closed the intratracheal tube must be kept in place until consciousness returns A breathing machine is used if respirations are not adequate Oxygen tent, caffeine quinidine sulfate or digitalis may be used as indicated Transfusions of whole blood and intravenous infusions of dextrose may be required Various drugs to elevate the blood pressure may be administered.

Experiences with Cardiac Arrest Although the hearts were revived in all 15 cases reported by Frank H. Lahey and Edwin R Ruzicka[7] (Lahey Clinic, Boston), only 7 patients survived the complication. The anesthetist and surgeon must watch the patient constantly, since cardiac arrest can occur at any time during induction of anesthesia and at any stage of operation The type of operation or the an

(7) Surg Gynec. & Obst. 90 108 118 January 1950

esthetic agent seems to be of no etiologic significance Factors of possible significance are the ability of chloroform, cyclopropane and ethyl chloride to sensitize the heart to the action of epinephrine, hypoxia, excitement, stimulation of the vagus nerve and too deep a level of anesthesia

As soon as the pulse and blood pressure disappear the surgeon must be notified Interruption of circulation to the brain for 3½ minutes or longer results in permanent changes in psychic behavior With such a short time limit good results can be achieved only by planned prepared and practiced efforts. A plan of action should be posted in every operating room and should consist of (1) artificial respiration with 100 per cent oxygen, (2) immediate cardiac massage by the surgeon an all important step (3) drug therapy with procaine and epinephrine, and (4) general methods, including administration of intravenous fluids and institution of 5 10 degree Trendelenburg position Drugs should be ready and mixed (0.5 cc epinephrine 1 1 000 and 9 5 cc procaine, 1 per cent) in a sterilized syringe with needle so that both drugs may be administered in one injection.

Artificial respiration presupposes an unobstructed air way, and if an endotracheal tube is not already in use one should be inserted The heart should be punctured with the needle of the syringe containing procaine and epinephrine, blood aspirated and the solution injected before beginning cardiac massage However massage must be started without delay if a favorable outcome is hoped for Approach to the heart may be transperitoneal subdiaphragmatic, transperitoneal transdiaphragmatic or transthoracic, depending on the operative procedure in which the arrest occurs. Compression should be gradual and relaxation abrupt with the rate of compression at most only half the normal rate Massage must be interrupted at regular short intervals for a few seconds to allow spontaneous beats to develop If these are present but do not improve, administration of epinephrine may be of great aid Procaine is combined with epinephrine since it offers protection against a sudden burst of vagus activity which might cause cessation of the renewed heart beat. To facilitate prompt application of cardiac massage instruments for opening the ab-

domen and chest should be available in the operating room at all times in a specially labeled container

In some cases of cardiac arrest injection of the 10 cc procaine-epinephrine mixture is best done by the quickest and most easily accessible intravenous route, preferably through an antecubital vein. Age and debilitation may indicate limiting the dose to 5 cc., but if the heart has not resumed activity soon after cardiac massage has begun the next 5 cc. may be injected directly into the heart, preferably the cavity of the right auricle or ventricle Then if cardiac activity is slow in returning epinephrine should probably be omitted until there is some return of automatic cardiac activity, but procaine should be repeated or kept running in a continuous intravenous drip until regular cardiac action is restored.

[The two preceding articles are included to emphasize that something can be done about cardiac arrest and fibrillation but that action must be taken immediately Although results are often discouraging, they should not deter surgeon and anesthetist from being prepared to diagnose and institute effective therapy promptly—Ed.]

Electrocardiographic Studies during Endotracheal Intubation Effects during Usual Routine Technics were observed by Charles L. Burstein, Francis J LoPinto and W Newman[8] (Veterans' Admin. Hosp., Bronx N Y) Electrocardiographic disturbances were recorded in 73 of 109 patients during endotracheal intubation. In 43, sinus tachycardia developed when the tube was introduced. Other changes at the time of intubation consisted of premature ventricular contractions with bigeminal or trigeminal rhythm, nodal rhythm sinus bradycardia decreased voltage of the T wave increase in P R interval, sinus arrhythmia ventricular tachycardia and auricular fibrillation. Of 50 patients intubated during the second plane 86 per cent showed electrocardiographic changes when intubation was performed during the third plane, 56 per cent of 34 patients showed disturbances

The type of anesthesia may be a factor but was not consistent in this small series Cocainization seemed to increase the number of changes Insufficient depth of anesthesia prolonged laryngoscopy with numerous attempts at intubation respiratory obstruction before intubation and tracheal

(8) Anesthesiology 11 2 4 3 March 1950

irritation after intubation were important factors in producing disturbances All electrocardiographic changes recorded were transitory and of no grave consequence

[Although there is good reason to believe that controls in this study are not adequate, the report does indicate a significant association of cardiac irregularities and tracheal manipulations and that these manipulations cannot be undertaken without hazard.—Ed.]

Mechanism of Cardiac Arrhythmias during Cyclopropane Anesthesia. In 34 normal unpremedicated cats anesthetized with a mixture of cyclopropane and oxygen, J W Stutzman and F L Pettinga[9] (Boston Univ) made controlled electrocardiograms which showed ventricular premature contraction, ventricular rhythms with occasional supraventricular beats, bigeminal rhythm and multiple focus ventricular tachycardia at rates in excess of 250/minute These arrhythmias persisted for an average of 22 8 minutes. On a subsequent day the animals were similarly anesthetized and as soon as cardiac irregularities occurred partial abdominal evisceration, partial abdominal denervation or bilateral adrenalectomy was performed Removal of spleen, gastrointestinal tract and accompanying mesentery from cardia to rectum abruptly abolished ventricular arrhythmias in five of seven cats. In 7 of 10 cats sectioning nerves at the base of celiac and superior mesenteric arteries and removing the portion of the plexus and semilunar ganglion between these vessels and the aorta abruptly abolished the arrhythmias and in 1 there was reversion to sinus rhythm with an occasional premature contraction. Bilateral adrenalectomy reverted the pre-existing ventricular tachycardia to a supraventricular rhythm within two minutes in 15 of 17 cats In six animals in which irregularities were abolished by adrenalectomy epinephrine was injected intravenously in a dose of 2 5-10 γ/kg and was followed by ventricular arrhythmias in all animals. After partial abdominal denervation epinephrine injection resulted in ventricular arrhythmias in only one of the six animals

On the basis of this work it is concluded that cyclopropane increased the irritability of the cat heart reflexly Afferent impulses from the mesentery or intestine are carried by fibers traveling with the splanchnic nerves Efferent impulses pass to the heart by way of the cardiac sym

(9) Anesthesiology 10 374-378 July 1949

pathetics. Under the conditions described endogenous epinephrine apparently elicits spontaneous arrhythmias through the mediation of this reflex

Effect of Dibenamine on Cyclopropane-Epinephrine Arrhythmias Norman B J McMillen, L Jennings Hampton and Victor A. Drill[1] (Yale Univ) found that when 16 per cent cyclopropane was administered to dogs respiratory exchange was adequate and spontaneous arrhythmias did not occur During cyclopropane anesthesia, injection of 0 7 1 8 γ epinephrine/kg changed normal sinus rhythms to ventricular arrhythmia Duration of the arrhythmias varied from 22 to 99 seconds Ventricular fibrillation caused the death of one dog After administration of 20 mg dibenamine/kg., between 89 and 300 γ epinephrine/kg was required to induce ventricular arrhythmias in dogs anesthetized with 16 per cent cyclopropane

Protection against Cyclopropane-Epinephrine Arrhythmias by Dibenamine and Other Agents Mark Nickerson and Scott M Smith[2] (Univ of Utah) induced arrhythmias in 134 experiments performed on 84 dogs anesthetized with cyclopropane by intravenous injection of a standard challenge dose of epinephrine 10 μg /kg Unless fatal ventricular fibrillation occurred, the entire test dose was administered in 50 seconds, but ventricular tachycardia usually developed after about one half the amount had been given. Standard limb lead electrocardiograms were begun before epinephrine was given and continued until the control rate and rhythm had returned. Dibenamine hydrochloride in doses of 20 mg /kg or similar doses of priscoline® hydrochloride (2 benzyl imidazoline) provided much greater protection against the cardiac irregularities than ergotamine tartrate atropine sulfate meperidine hydrochloride (demerol®) procaine hydrochloride or quinidine sulfate

The fact that larger doses of dibenamine or priscoline® were required to eliminate cardiac irregularities than to reverse the pressor effects of the same dose of epinephrine indicates that the peripheral action of these agents in preventing the peripheral response to epinephrine is not the essential factor though it may contribute to the protection.

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(1) Anesthesiology 11 8 18 January 1950.
(2) Ibid. 10 54 5 6 September 1949

When epinephrine dosage was 100 mg./kg., priscoline* provided only limited protection, in contrast to the essentially complete protection afforded by dibenamine against all doses of epinephrine, probably owing to a much greater adrenergic blocking effectiveness of dibenamine The only cardiac action of epinephrine studied to date which is blocked by dibenamine is the production of irregularity Dibenamine does not significantly alter the period required for the heart to return to its normal rate after injection of epinephrine nor does it alter the increased stroke volume and output following epinephrine

All the effective agents except meperidine and ergotamine acted primarily by causing an earlier cessation rather than a delayed onset of arrhythmias Ergotamine and meperidine decidedly delayed the onset of irregularities but with ergotamine a considerable part of this delay was apparently due to circulatory slowing These observations imply that a sudden increase in concentration rather than total concentration of epinephrine is the more important factor in initiating cardiac irregularities and that the peripheral action of epinephrine is not of primary importance in development of arrhythmias.

In contrast to the results of other investigators, procaine was ineffective against ventricular fibrillation It was effective in stopping ventricular extrasystoles in ventricular tachycardia The short duration of protection afforded by procaine points to a limited prophylactic value

Vagovagal Reflexes Electrocardiographic Changes during Vagotomy Miles J Gullickson, James H. McRae and Darrell A. Campbell[3] (Eloise, Mich.) performed bilateral vagotomy between the pulmonary plexus and stomach by left transthoracic approach on 10 dogs. Electrocardiographic records show that on 11 occasions in five animals there were decreases in rate changes in amplitude or inversion of P wave variations of the P R interval, dissociation phenomena or sinus arrhythmia and sinoauricular block. Although these were specifically related to manipulations of the vagus, similar and other changes also occurred without relation to visceral or vagal stimulation. Tracings reverted to nor

(3) Surg Gynec. & Obst. 89 153 159 August, 1949

mal simultaneously with or shortly after closing of the chest.

Changes apparently related to handling of a vagus nerve —lengthening of the P R interval—occurred in 2 of 10 human subjects who had bilateral vagotomy for duodenal or marginal ulcer Other electrocardiographic abnormalities were observed but were not related to a specific mechanical stimulus Stimulation of the vagus nerves proximal to the heart may cause sinus arrhythmia, bradycardia, cardiac arrest, P wave changes, dissociation phenomena, nodal rhythm, premature contractions, variations in the amplitude of the R wave, flattening of the T wave and prolongation of the P R interval. Similar changes occurred in this series but their clinical importance should not be overestimated since factors such as the irritant effects of anesthetic vapors, passage of bronchoscopes and endotracheal tubes, deep respirations artificial respiration, direct stimulation of the heart and nausea and vomiting cannot be entirely eliminated Conditions resulting from anesthesia which render the vagi more receptive to a given stimulus include increased sensitivity and irritability of cardiac tissue, changes in the physiologic efficiency of the conduction mechanism and alterations in vagal tone Receptivity also varies from person to person and in each individual at different times

To avoid an occasional mishap during vagotomy certain precautions should be taken. (1) Morphine should be omitted as preanesthetic medication, but barbiturates and atropine are indicated. (2) Ether is the anesthetic of choice (3) Use of curare affords additional protection. (4) Good oxygenation is imperative (5) An adequate dose of atropine should be administered intravenously before search for the vagi is begun. (6) Injection of procaine into the vagal trunk before isolation of nerves is of little prophylactic value since it is preceded by mechanical stimulation. (7) Section of nerves should be carried out with minimal traction or other trauma and ligation of their central ends should not be done routinely

Anesthetic Problems in Cardiac Surgery in Children are discussed by William O McQuiston[4] (Children's Memorial Hosp., Chicago) who has had experience in more than 200 cases The low cardiac reserve and susceptibility to excitement or fear make depression of metabolic activity and psychic sedation the most important considerations in preoperative medication. Infants tolerate morphine well. Age and not weight determines the size of the dose An infant, 2 or 3 months old, weighing 7-8 lb, is given 1/48 gr morphine and 1/300 gr atropine A child aged 4, receives 1/8 gr morphine and 1/200 gr atropine, and older children usually receive 1/6 gr morphine and 1/200 gr scopolamine The patients should be sufficiently depressed so that, if undisturbed, they will be drowsy or asleep when they reach the operating room A cannula should be inserted into the saphenous vein at the ankle after induction of anesthesia for continuous administration of fluids in emergency therapy

Cyclopropane is used as the principal agent for all cardiac surgical procedures, even in the presence of arrhythmias. Administration is by the to-and fro absorption technic with controlled respiration. Special face masks and soda lime canisters were designed for small infants to eliminate dead air space All children are intubated before being turned on their sides. Tubes should be chosen to fit tightly but yet not to cause pressure damage to the vocal cords. At the time anastomosis is being performed, respiratory efforts constitute a warning of dangerous asphyxia and should not be masked with curare preparations unless it is absolutely necessary to permit completion of the anastomosis.

Next to anoxia the most frequent serious complication is cerebral accident. Cerebral thrombosis results from the increased viscosity of the blood due to elevated red cell content Thus bradycardia and/or hypotension are not well tolerated and must be treated promptly As little as 1/1000 gr

(4) Anesthesiology 10 590-600 September 1949

atropine administered intravenously will produce a striking effect on the heart rate and blood pressure In addition, 100 per cent oxygen should be administered and the hilar area cocainized with 5 per cent cocaine

To counteract the deleterious effects of hyperthermia and oxygen demand in hypoxic children, hypothermia was induced in 25 patients. Ice bags were used to decrease rectal temperature to 96 F Clinical impressions were that mortality and morbidity would have been higher had refrigeration not been used None of this group died of anoxemia or cerebral accident

Postoperative complications probably due to anesthesia included cough, without or with mucus in 18 and laryngeal edema in 8 The most satisfactory treatment for children with laryngeal edema is to place them in a steam room with the humidity of a Turkish bath but a maximal temperature of 75 F In two patients tracheotomy was done

In 127 patients with tetralogy of Fallot in whom anastomosis was completed there was a mortality of 10 1 per cent, and in 15 in whom anastomosis was not possible the mortality was 40 per cent The commonest cause of death was anoxia (six patients) Cerebral hemorrhage or cerebral thrombosis caused death in four The mortality was 14.5 per cent in patients under age 3 and 3 8 per cent in those over 3

Anesthesia for Operations on Heart and Great Vessels is discussed by G A. Light H. M Livingstone and W E Adams[5] (Univ of Chicago) who have had experience with 50 cases. There were two operative deaths, one due to coronary occlusion and the other to anoxia and cardiac failure resulting from insufficient pulmonary circulation with an open chest in a patient with congenital pulmonary stenosis None of four postoperative deaths were attributable to the anesthesia

Preoperatively the patient with cardiac disease must be thoroughly studied and the general condition improved as much as possible Enough preoperative medication should be given to allay apprehension, but oversedation and over depression of the reflexes must be avoided. Most young children with congenital defects of the heart received no pre medication, and excitement during induction was avoided by

(5) Arch. Surg 60 42-64 January 1950

winning confidence of the child and carefully administering vinyl ether or gas

During operation the *anesthesiologist must cope with the* effects and possible complications of an open chest, open mediastinum and direct operative manipulation of the heart and great vessels Under such circumstances ventilation must be controlled adequately, yet the structures must be kept relatively quiet so that the surgeon's work will not be too difficult. The open chest alters pressure relationships, gas exchange, respiratory rhythm and blood circulation. The lung on the opposite side may also be affected through movements of the mediastinum and effects of change of mediastinal position on the vagi

Lack of sufficient gaseous exchange between alveolar and circulating blood and particularly inadequate oxygenation of blood must be corrected by providing adequate inhalation pressure along with an increase in oxygen concentration delivered to the alveoli If paradoxic respiration (sucking in of chest during inspiration) occurs in the unopened side of the chest it may be corrected by increasing the inhalation pressure Intratracheal tubes must be of adequate bore to insure good respiratory exchange and be kept clear of any secretions It is dangerous to allow too much atelectasis to occur in the exposed lung or any degree to exist for a long period If blood continues to circulate through these atelectatic areas it returns to the general circulation without receiving the necessary oxygen. A collapsed lung sets up a prolonged inspiratory effort whereas forcible overdistention of the lungs with positive pressure results in a prolonged expiratory effort. The best inhalation pressure is usually between + 6 and + 15 mm. Hg and the exhalation pressure between + 2 and + 5 mm. If pulmonary ventilation is not adequate carbon dioxide may accumulate rapidly Therefore, respiratory exchange must be ample enough to eliminate excess carbon dioxide as well as to supply the needed oxygen.

Circulatory *effects of an open chest are partly* due to a venous stasis but more serious effects may be produced by vagal stimulation which cause irregularities of the cardiac action Though some irregularities may be due to vagal stimulation, others may result from mechanical effects of

the operation, pneumothorax or the anesthetic agent through its action on the myocardium or on coronary vessels.

Because of these considerations it is recommended that a relatively standard method for caring for these patients, varying it somewhat according to individual factors, be adopted. In this way the anesthetist will be better able to perfect his technic The method should provide the best possible ventilation of the alveolar air spaces and minimize the anesthetic "dead space" It should be as simple and as free from potential complications and hazards as possible. Induction and recovery should be minimized The patient should be awake before being returned to bed. The anesthetic agent chosen must be potent in presence of high percentages of oxygen. In this series ether was the chief anesthetic component for most patients. A tight-fitting face mask was used throughout Cyclopropane was not used because of the danger of cardiac irregularities which this agent in itself may produce The possibility of shock should be anticipated by introducing a cannula into an ankle vein and having isotonic sodium chloride solution or plasma running slowly so that speed of the intravenous infusion can be increased at a moment's notice Properly typed blood should be prepared and kept at hand for transfusion. Postoperatively, oxygen should be administered for at least 24 hours A tent is used for young children and nasopharyngeal insufflation for older persons A machine for administering mask oxygen under positive pressure should be kept ready for instant use for at least 24 hours postoperatively

In 16 diagnostic catheterizations of the heart the patients were given atropine preoperatively only when thiopental sodium was used as the anesthetic agent A cleansing enema was given the evening before operation and the patient accurately weighed to compute the dosage of the basal rectal anesthesia. Tribromoethanol solution for the average patient is required in a dosage of 100 mg./kg The dose of thiopental sodium is 1 Gm./50 lb Mask oxygen and suction equipment should be immediately available at all times. During operation an oral airway is introduced and the chin moderately extended or the mandible supported anteriorly The anesthetist should take adequate measures to protect his hands from the rays of the fluoroscopy screen.

[The two preceding papers represent two somewhat different approaches to the problem of anesthesia for patients with serious heart abnormalities. Although personal preferences usually dictate the actual choice of agent and technic, both articles emphasize the necessity for close supervision to detail.—Ed.]

ETHER

Classification and Significance of Electroencephalographic Patterns Produced by Nitrous Oxide Ether Anesthesia during Surgical Operations. Raymond F Courtin, Reginald G Bickford and Albert Faulconer Jr [6] studied electroencephalograms made on 23 men and 22 women receiving nitrous oxide ether anesthesia during operations, most of which were intraperitoneal procedures A constant relationship was found between the electroencephalographic pattern and depth of anesthesia. Since the patterns are the result of increased nitrous oxide-ether concentrations in the brain, they are a direct measure of the depth of anesthesia. The presently accepted signs of depths of anesthesia such as muscle relaxation and reflex action are essentially peripheral effects

During anesthesia a maximal discharging focus occurs in the precentral region of the brain. This is of interest since a similar distribution of potential fields has been noted in sleep rhythms.

The electroencephalographic patterns associated with deepening anesthesia can be classified into seven levels of anesthesia (Fig 188) The first level is associated with loss of consciousness and analgesia, and the tracing is almost flat with absence of normal alpha frequencies. Excitement and restlessness, if present, occur during the latter part of the first level and continue into the second level, which consists of high amplitude rhythmic discharges. The first and second levels are unsuitable for any surgical operations requiring more than analgesia. Insertion of skin clips and skin incision should not be completed until the patient has entered the third level which has a complex wave pattern with little rhythmicity or tendency to repetition. This is

(6) Proc. Staff Meet., Mayo Clin. 25 197 206 Apr 12, 1950

the stage of light surgical anesthesia in which operations not requiring muscle relaxation can be carried out. Abdominal operations requiring muscle relaxation are satisfactorily performed at the fourth and fifth levels, which are characterized by progressive suppression of cortical activity. These levels are also suitable for passage of intratracheal tubes. The sixth level is unnecessarily deep for surgery, and the pattern shows periods of activity which occur no more fre-

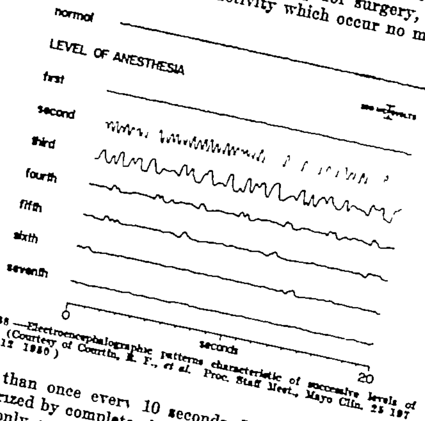


Fig. 188.—Electroencephalographic patterns characteristic of successive levels of anesthesia. (Courtesy of Courtin, R. F., et al. Proc. Staff Meet., Mayo Clin. 25:197-06 Apr 12 1950.)

quently than once every 10 seconds. The seventh level is characterized by complete absence of measurable waves and is seen only under conditions of anesthetic difficulty or complication. This level is often associated with respiratory failure.

Mechanism of Hyperglycemia during Anesthesia. Experimental Study. Sven Rune Johnson[7] (Karolinska Inst., Stockholm) studied the effects of ether anesthesia on blood sugar levels of rabbits before and after bilateral adrenalectomy and the effects of high spinal anesthesia on blood sugar levels of intact animals. In five rabbits ether anesthesia

(7) Anesthesiology 10:379-386 July 1949

of 15 minutes' duration which eliminated corneal reflexes resulted in a rapid rise of blood sugar from 100 mg./100 cc. to as high as 250 mg./100 cc. For 15 minutes following termination of anesthesia blood sugar levels continued to rise somewhat but returned to normal after two to three hours. When anesthesia was continued 60 minutes the blood sugar usually rose to over 300 mg./100 cc. and did not return to normal until after 3-4 hours. Hypoxemia induced by breathing pure nitrous oxide until respiratory arrest occurred resulted in blood sugar levels of about 200 mg./100 cc. In animals which had been subjected to bilateral adrenalectomy, neither ether narcosis for 15 minutes nor hypoxemia induced by breathing pure nitrous oxide resulted in an increase in blood sugar. In rabbits with high spinal anesthesia above the fourth thoracic segment ether anesthesia did not cause any rise in blood sugar but in rabbits under spinal anesthesia extending to the sixth thoracic segment hyperglycemia followed anesthesia. *Nitrous oxide hypoxemia resulted in no rise in blood sugar* in the former group. High spinal anesthesia above the fourth segment effectively blocked the splanchnic nerves.

Ether anesthesia seems to produce a central nervous system stimulation which is transmitted to the adrenal glands by way of the sympathetic system. By hormonal action the adrenal glands cause glycogenolysis in the liver which results in hyperglycemia. Clinical application of these observations may be made in patients with liver damage when it is desirable not to deprive the liver of its glycogen stores. Spinal anesthesia if otherwise indicated, *should then* extend above the fourth thoracic segment; in this way the stimuli which lead to hyperglycemia will be neutralized.

Changes in Blood of Rat during Ether and Barbiturate Anesthesia were studied by Henry I. Kohn and Nancy Swingley[8] (Oak Ridge Nat'l Lab.). Barbiturates depressed the levels of hemoglobin, total protein and glucose. Ether elevated blood sugar slightly during the first minute of anesthesia but did not change the levels of hemoglobin, total protein, nonprotein nitrogen, chloride or cholesterol and did not alter the albumin/globulin ratio. *Especially striking* in both the starved and fed rat was the rapidity with which

(8) Am. J. Physiol. 160 277-284 February 1950

changes occurred It is important to recognize that the animal's nutritional state greatly affects the levels of hemoglobin, nonprotein nitrogen, protein and sugar and a wide variety of results may be obtained unless conditions are standardized

Since ether affects only glucose, it is the anesthetic of choice from the standpoint of derangement and simplicity Further advantages are that recovery takes but a few minutes and that ether is cheap and easy to administer

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BARBITURATES

Use of 0.1 per Cent Pentothal* in Clinical Anesthesia Unfortunate experiences with 2.5 per cent pentothal* in a large city hospital, where many conditions which are direct contraindications to pentothal* and perhaps to surgery are the rule rather than the exception, caused Patricia Mary Kamsler and J Eugene Ruben[9] (Philadelphia Gen'l Hosp) to change to 0 1 per cent concentration for routine use

METHOD.—The solution is prepared by dissolving a 5 Gm. ampule of pentothal* sodium in 50 cc. sterile distilled water The 0.1 per cent solution is prepared by mixing 10 cc. of the stock solution with 1 L. of 2.5 per cent dextrose in 0 62 per cent sodium chloride. This preparation is then used to supplement nitrous oxide-oxygen anesthesia, as an induction agent for nitrous oxide-ether or cyclopropane, as a complement to spinal anesthesia or to supplement a waning spinal anesthesia.

Dilute pentothal* is not an anesthetic per se but merely a basal anesthetic which must be supplemented with other agents. Use of enough pentothal* in any concentration to obtain the ordinarily required levels of clinical anesthesia is contraindicated for the poor risk patient.

The 0.1 per cent concentration was administered to 1,560 patients, almost half of whom had gynecologic surgery About 10 per cent had orthopedic and another 10 per cent urologic procedures. Sixty two patients were operated on in the prone position. Although pentothal* is not advocated for this position the 0.1 per cent solution with an endotracheal tube in situ is safer than more concentrated mix

(9) Pennsylvania M. J 52 1471 1472 October 1949

tures. In view of the physical status of the patients, the importance of low dosages such as 0 3 Gm. for cervical dilatation and curettage, 0 8 Gm. for craniotomy and 0 7 Gm. for mastectomy cannot be overemphasized. Discrete regulation of the flow of pentothal* is all that is required to prevent overloading of the circulation. The patients who cannot take a large quantity of fluid are the same poor risks who require only a small amount of pentothal.*

Some Modern General Anesthesia Technics Roger W Ridley and John S Lundy[1] (Mayo Clinic) describe a combination of pentothal* sodium and curare used for direct suspension laryngoscopy

METHOD —The larynx is cocainized with the patient awake. Unless anesthesia is adequate, laryngospasm is apt to occur when the surgeon begins manipulation. Oxygen is insufflated by means of a nasopharyngeal airway Then 2-3 cc. curare (6-9 mg d-tubocurarine chloride) is given slowly, a total of 5 cc. may be necessary for the whole procedure The patient is anesthetized with pentothal* sodium, 1 or 1.5 Gm. often being necessary for a relatively short procedure

With this technic the patient is frequently depressed almost to the point of apnea before the surgeon can work *without troublesome laryngeal reflexes Since efficient artificial respiration* is hindered by the lack of airtight fit between anesthesia apparatus and the patient's lungs, the anesthetic agent must be administered judiciously Favorable features are that the procedure is short, the operating surgeon can hold the cords open and oxygen can be insufflated into the lungs if necessary

A similar technic is used for esophagoscopy Preliminary medication includes moderate doses of morphine, atropine or pentobarbital sodium. A total of 9 mg d tubocurarine chloride and 500-750 mg pentothal* sodium is usually adequate

Esophagoscopy is usually a short procedure The greatest hazard is immediately postoperatively when the patient must be watched closely until he is breathing normally and can be easily aroused.

Intravenous Pentothal* Procaine Anesthesia. R. J Fraser[2] (Hamilton, Ont.) *has used pentothal* procaine* mixture in dilution for all types of operations with different anes-

(1) S. Clin. North America 29 1571 1582 October 1949
(2) Anesth & Analg. 28 208 212, July-Aug., 1949

thetic agents and found it of value for the well being of the patient protecting the cardiac conducting mechanism relieving pain and promoting urinary excretion. Pentothal* procaine in dilution has fewer toxic effects than procaine alone

Toxicity of procaine depends on individual tolerance to the drug percentage concentration, amount of detoxication by tissues, condition of patient's fluid and electrolyte balance and preoperative medication. Vitamin C and glucose may promote procaine tolerance and detoxication. Convulsive seizures were noted in three patients and others had a feeling of apprehension and inward trembling Most of these effects were caused by excessively rapid administration of the drug with consequent lack of detoxication. Some investigators suggest that large amounts of para ammo-benzoic acid might antagonize the convulsion producing action of procaine Procaine should not be administered while the patient is receiving sulfonamides

Pentothal* procaine is best used as an adjuvant to strengthen action of other anesthetic agents, but it may be used alone for repair of lacerations, plastic and orthopedic work curettage and treatment of burns. The solution is prepared by adding 1 Gm. pentothal* sodium and 1 Gm. procaine hydrochloride to 1 L of 5 per cent glucose in normal saline Procaine is used with cyclopropane until the latter is substituted or discontinued With other agents procaine may be discontinued at any time during operation. During kidney and prostate operations it is continued into the postoperative period if required to protect the urinary output When procaine is used intravenously the range between analgesia and anesthesia varies and the range between anesthesia and convulsions is narrow In case of toxic effects procaine should be discontinued immediately and barbiturates administered intravenously in conjunction with administration of extra oxygen.

Circulatory Collapse Following Combined Use of Pituitrin* and Pentothal.* D W Hesselschwerdt and S E. Medburys (U S Naval Hosp Bethesda, Md.) observed two patients in whom severe shock developed after they were given 10 units (1 cc) of pituitrin* while under pentothal*

(3) Anesthesiology 10 544 547 September 1949

hypnosis Repeated injections of similar amounts after recovery from pentothal* produced no recurrence of shock.

The role of pentothal* in precipitating pituitrin* shock is not specific Pituitrin,* through its pressor factor, pitressin,* may cause coronary artery constriction and in conjunction with pentothal,* which may cause direct myocardial depression, may produce shock.

Corrective treatment for such shock consists of oxygenating the patient and administering epinephrine or ephedrine to counteract the coronary constriction. To avoid development of shock, pitocin,* the oxytocic factor of pituitrin,* or ergonovine should be used instead of pituitrin.*

Preanesthetic Hypnosis with Rectal Pentothal* in Children Lester C Mark, John L. Fox and Charles L. Burstein[4] (New York City) have eliminated preoperative apprehension in children by use of rectal pentothal* hypnosis.

METHOD.—A simple cleansing enema is given the night before operation. Preoperative hypodermic medication is routinely used, but if demerol* is used belladonna drugs are eliminated. Pentothal* sodium in 10 per cent solution is freshly prepared and administered rectally 30 minutes before the scheduled time of operation. Accurate dosage is based on a standard of 1 Gm./75 lb body weight. Appropriate consideration is given to abnormal weight or metabolic rate. A 10 cc. syringe fitted with a metal syringe tip adapter for attachment of a soft rubber 10 F catheter is used. The internal capacity of the catheter is measured and this extra amount of pentothal* solution is added to each dose prepared. After instillation, the catheter is withdrawn from the rectum still attached to the syringe in order to retain its intrinsic volume of solution and insure precision of dosage.

With this preparation anesthetic agents and technics of many types were used for 100 children aged 10 months to 11 years who were subjected to orthopedic or general surgery averaging 42 minutes in duration. In 5-15 minutes after rectal pentothal* instillation 66 per cent of the children were asleep, and the remainder were drowsy, quiet and submissive Transfer to the operating room and induction of anesthesia evoked no response in 73 per cent of the sleeping children the remainder squirmed feebly or opened their eyes questioningly but on gentle reassurance submitted quietly The children who were awake but drowsy co-operated fully without disturbance and without display

(4) Anesthesiology 10 401-405 July 1949

of fear There were a few minor complications during anesthesia but there were no postoperative complications attributable to rectal administration of pentothal.®

Potentiating Effect of Glucose and Its Metabolic Products on Barbiturate Anesthesia. While preparing to inject glucose intravenously into a dog anesthetized with pentobarbital sodium, Paul D Lamson, Margaret E Grieg and B Howard Robbins[5] (Vanderbilt Univ) noted that the dog suddenly came out of anesthesia The animal responded normally when spoken to and tried violently to get off the table On intravenous injection of glucose the dog instantly relaxed, going into deep sleep and complete anesthesia exactly as after an injection of a barbiturate Other experiments showed that in dogs responses to glucose after barbiturates varied widely However practically 100 per cent of guinea pigs given 1 ml. glucose solution intraperitoneally after awakening from hexobarbital anesthesia responded with a return to sleep

Solutions of sucrose or sodium chloride do not produce such an effect indicating that the effect is not osmotic The reaction to glucose has been obtained after use of hexobarbital, narconumal, seconal® sodium and pentothal® sodium, but no such reaction was obtained after ether chloral or chloralose Intermediary products of glucose metabolism such as hexose diphosphate lactate pyruvate succinate and fumarate as well as malonate and the water extract of both brewers' and bakers' yeast produce the same effect, some more strongly than glucose Apparently there is a potentiation of barbiturate anesthesia by glucose and its metabolic degradation products.

[With this evidence one might exercise caution in the concomitant use of barbiturates and glucose solutions, a rather common practice in the clinic. —Ed.]

Role of Liver in Detoxication of Thiopental (Pentothal®) by Man. F E Shideman, A. R Kelly L E Lee, V F Lowell and B J Adams[6] (Univ of Michigan) report that in 10 persons whose age averaged 28 and who had normal albumin/globulin ratios and bromsulfalein retention the mean duration of action of 4 mg /kg of 4 per cent solution of thiopental sodium was 151 5 seconds. In eight patients with

(5) Science 110 690-691 Dec. 23, 1949
(6) Anesthesiology 10 421-428 July 1949

out evidence of liver dysfunction (average age 53.9) the duration of action did not differ significantly In six patients with an average age of 58 2 years, bromsulfalein retention ranging from 12 to 40 per cent and albumin/globulin ratios from 0 89 to 1 43, the mean duration of action was 488.5 seconds

Although demonstrable liver dysfunction in man results in prolongation in action of anesthetic doses of thiopental, such a pathologic condition is not an absolute contraindication to use of barbiturates known to be detoxified primarily by the liver With anesthetic doses the detoxication mechanism of the liver is not taxed and there remains considerable hepatic reserve for this process. It is only when less than 30 per cent of functioning liver tissue remains that the reserve is exceeded There is no way of estimating the detoxicating capacity of the liver for thiopental in hepatic disease and for this reason anesthetists and clinicians should be aware that thiopental tolerance in a person with sufficiently severe hepatic dysfunction will be less than that in a normal subject.

Use of Thiopental Sodium Intravenously in Presence of Hepatic Damage Experimental studies are reported by Clarence H Walton, Judd W Uhl, Willadene M. Egner and H. M Livingstone[7] (Univ of Chicago) No significant evidence of hepatic damage was produced in normal dogs by thiopental sodium alone in moderate dosage Hepatic damage was experimentally produced in 24 dogs by administration of chloroform and oxygen. In controls given no thiopental after liver damage hepatic function returned to normal in six days as measured by prothrombin levels In dogs given thiopental sodium intravenously without oxygen after liver damage it was 10-18 days before prothrombin levels reached normal When thiopental and oxygen were given there was no retardation of recovery of liver function. This experiment suggests that impairment of liver function is not due to a specific effect of thiopental.

Tissue Distribution with Time after Single Intravenous Administration of Pentothal® Sodium (Sodium Ethyl [1 Methylbutyl] and Pentothal® S^{35} Thiobarbiturate) Jesse L. Bollman, Lowell M Brooks, Eunice V Flock (Mayo

(7) Arch Surg 60 986-994 May 1950

Found) and John S Lundy's (Mayo Clinic) injected pentothal® 40 mg/kg, intravenously into male white rats weighing about 200 Gm and killed the animals 30 seconds to 2 hours after injection. At this time the animals blood was collected and the organs excised and frozen Subsequent analysis disclosed that pentothal® is rapidly distributed in the body and that the greatest concentration in each tissue is reached within one minute after beginning intravenous injection There was no subsequent pronounced accumulation in any of the tissues studied Concentration in the major tissues did not differ greatly from that of the plasma at any time though concentration in liver and kidneys is somewhat greater than that of plasma brain, muscle lungs and intestines After immediate distribution of pentothal® to tissues there is a subsequent slow decline of the amount in each tissue at about the same rate

Studies on two dogs whose major lymphatics from the small intestine had been cannulated showed that the lymph acquired a high concentration of pentothal® immediately after injection Subsequently the concentration declined to that of the declining concentration of the plasma

The studies revealed no evidence of destruction of pentothal® by a specific organ

[The three preceding articles indicate the continuing perplexity concerning the predominant site of detoxication of thiopental sodium. There is however growing evidence that the liver is intimately associated with the disappearance of the drug and caution should be exercised in use of the drug in patients with liver dysfunction.—Ed.]

Distribution of Radioactive S35 of Thiopental (Pentothal®) in Rabbit and Cat. According to J D Taylor, R. K. Richards and D L. Tabern[9] (North Chicago Ill.) the largest concentration of thiopental 10 minutes after injection into rabbits occurs in the liver and kidneys At the same time content in the brain is similar to that in blood, whereas content in skeletal muscle is intermediate on a per gram basis. Body fat is also capable of taking up a significant amount of thiopental a factor which should be considered in administering the agent to obese patients

Distribution of thiopental in the cortex, white matter, cerebellum and thalamus of brains of cats showed differ

( ) Anesthesiology 11 1 7, January 1950
(9) Anesth. and Analg 9 101 105 Mar Apr., 1950

ences among the regions at any one time, but none was statistically significant. The question of localization of barbiturates in the central nervous system cannot be considered definitely settled. More sensitive methods for the detection of specific localization are required

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NITROUS OXIDE

Nitrous Oxide Anesthesia without Hypoxia. William Neff, Edward C Mayer and Richard Thompson[1] (Stanford Univ) review and re-evaluate the present status of nitrous oxide Combined with oxygen in atmospheric proportions this gas usually results in only a moderate degree of muscle relaxation in an adequately premedicated patient. Superimposing oxygen lack results in additional relaxation, but with severe hypoxia the muscles become rigid In practice, oxygen concentration should not be reduced more than 2 per cent below its atmospheric concentration. The use of oxygen in higher than atmospheric proportions does not insure good ventilation for the patient suffering from depressed ventilation and accumulation of carbon dioxide Oxyhemographic studies and clinical observation indicate that it is more rational to increase the proportion of nitrous oxide than arbitrarily to maintain oxygen in excess and therefore be obliged to administer larger doses of hypnotics, narcotics or muscle relaxants than would otherwise be required for light anesthesia When nitrous oxide is administered without oxygen induction may be smooth but with addition of oxygen in atmospheric proportions anesthesia lightens and the more vigorous patients enter delirium. Administration of a combination of nitrous oxide and 6 or 8 per cent oxygen results in unsatisfactory induction and unpleasant subjective sensations when compared to results with 100 per cent nitrous oxide With adequate oxygen the time of induction is not limited and despite the lower partial pressure the maximal tissue concentration of nitrous oxide compatible with safety is ultimately achieved Preoxygenation

(1) Brit M J 1 1400-1404 June 17 1950

with 100 per cent oxygen for 5 or 10 minutes before addition of nitrous oxide facilitates induction. The concentration of nitrous oxide may be rapidly or slowly increased and as long as the oxygen percentage is held near atmospheric the patient does not experience the unpleasant sensations associated with hypoxia. Elimination of carbon dioxide prevents occurrence of subjective disturbances Demerol® supplementation is usually required to provide adequate reflex obtundation with an 80 20 mixture of nitrous oxide and oxygen In cases not requiring endotracheal intubation, when the full effect of nitrous oxide is obtained, smaller doses of demerol® (20 or 30 mg initially, followed by doses of 10 mg as needed) may be used.

When muscle relaxation is required, nitrous oxide supplemented with demerol® plus curare provides satisfactory anesthesia for most surgical procedures When ether is used to facilitate endotracheal intubation, the anesthetic mixture is nonexplosive within 10 minutes after discontinuance of ether provided it has not been administered for more than 8 minutes Anesthesia should be maintained with a continuous flow of 80 20 nitrous oxide and oxygen and carbon dioxide eliminated with soda lime using the to-and fro method. The usual flow rates are 4 L./minute for nitrous oxide and 1 L./minute for oxygen. These rates should be doubled before during and for a short time after any interruptions in anesthesia for insertion of an airway or changing of a canister A pharyngeal airway should be inserted early in all cases, whether or not the patient appears to require one Nitrous oxide anesthesia is probably contraindicated in operations such as lobectomy for bronchiectasis in which frequent interruptions of anesthesia are necessary Splanchnic block with 60 ml. of 1 per cent procaine with epinephrine in 1 200 000 concentration is a useful supplement for extensive intra-abdominal operations For intrathoracic procedures procaine block of sympathetic chain, phrenic and vagus nerves under direct vision provides better operating conditions and insures greater freedom from traction reflexes. Ether anesthesia is probably more suitable for the Blalock operation when a patient already suffering from oxygen lack must be subjected to additional hypoxia during operation. Recovery from nitrous

oxide anesthesia is almost immediate and usually uncomplicated

Supplementation with Demerol® during Nitrous Oxide Anesthesia. Experiences with 248 patients who received barbiturates and demerol® as supplements to nitrous oxide anesthesia and 69 in whom demerol® was the only supplement are reported by Milton Brotman and Stuart C Cullen[2] (State Univ of Iowa)

METHOD —Nitrous oxide was administered by semiclosed, carbon dioxide absorption technic. Circle absorption was used in most cases, but the to-and fro method was used for children and in thoracic surgery A constant flow of 3.5 L. nitrous oxide to 1.5 L. oxygen/minute was maintained Frequently sodium pentobarbital by mouth preceded demerol® with atropine or scopolamine as preanesthetic medication. When demerol® was given by subcutaneous or intramuscular injection 20-30 minutes was required for the desired effect to become apparent In determining dosage 100 mg demerol® may be considered approximately equivalent to 10 mg morphine sulfate and the dosage adjusted in accordance with the patient s age, vigor and physical condition. Immediately before and during induction with nitrous oxide, additional demerol® was given intravenously in divided doses. To facilitate rapid induction in certain cases small doses of pentothal® sodium may be given at this time. If muscular relaxation is desired curare may be administered. During surgery maintenance doses of demerol® should rarely exceed 25 mg The full effect of such doses following intravenous injection can usually be evaluated in five minutes Demerol® is not recommended as a supplemental drug in operations which are expected to be completed in less than 30 minutes.

Oral endotracheal intubation can be accomplished with the aid of intravenous demerol® and careful cocainization of the oropharynx and upper trachea Laryngoscopy and intubation are performed before induction of general anesthesia. This technic, though not advocated for routine use, is of considerable advantage in selected cases and can be accomplished with minimal discomfort and high degree of amnesia for the procedure It is especially useful when there is a hazard of vomiting and aspiration during induction of general anesthesia or when excessive sputum is a factor

The two groups of patients were comparable with respect to age physical status, surgical procedures and complications About 37 per cent were over 60 and major respiratory circulatory or gastrointestinal preoperative complications were not uncommon Of the 10 deaths, none appeared directly related to the anesthetic agents used.

( ) Anesthesiology 10 696 705 November 1949

All 11 major circulatory derangements during anesthesia were referable to the surgery performed. Major respiratory depression or apnea occurred in four patients during anesthesia before experience concerning proper dosage and timing of injections of demerol® had been acquired. Such respiratory disorders can be avoided when experience with the technic is adequate.

Atelectasis sufficient to cause major respiratory disturbance occurred in seven patients postoperatively but was not thought due to anesthesia. The six instances of major post operative circulatory disorders were associated primarily with disease processes.

The combination of demerol® and nitrous oxide was associated with relatively rapid recovery of protective reflexes and ability to co-operate in nursing procedures even after prolonged operations. Little depression or impairment of respiratory and circulatory compensatory mechanisms occurs when the anesthesia is properly used. This method may be used safely in elderly patients and for those in the poor risk group since the incidence of complications has been relatively low in such patients even though most operations were of a major type.

[As indicated in the two preceding reports, there is a pronounced tendency to use nitrous oxide in nonhypoxic concentrations for all types of surgical procedures. It is an advantageous drug and technic in many respects but the technic requires experience and the ability and knowledge to assess accurately the patient's responses to drugs.—Ed.]

SPINAL AND EPIDURAL ANALGESIA

Departure of Substances from Spinal Theca. F. Howarth and Eugenia R. A. Cooper[3] (Univ. of Manchester) investigated the degree of cephalic spread in cats of radioactive dibromoprocaine, radiosodium, radiophosphorus and radiobromine injected intrathecally. Specimens of cerebrospinal fluid were taken from the lumbar subarachnoid space and cisterna magna of 30 animals and subjected to radioassay. In no case was a concentration found in the cisternal fluid which could account for the rapid decrease in the concen

(3) Lancet 2 937 940 Nov 19 1949

tration in the lumbar fluid Maximal cisternal concentrations were often so low as to render assay impractical. Apparently, cephalic extension had little to do with reduction in local concentration.

In 12 cats dibromoprocaine was introduced into the spinal subarachnoid space by sacral cannula. Essentially similar concentrations were found in the blood from the vertebral, internal and external jugular, inferior and superior venae cavae, veins most likely to drain the spinal subarachnoid space Specimens from the azygos vein at its junction with the superior vena cava contained greater concentrations than any other vein examined This is strong evidence against the concept that spread is from the point of injection to the cranial subarachnoid villi to the venous system. The other radioactive substances departed from the lumbar subarachnoid space in the same fashion

Although the relative importance of the part played by the azygos vein in total venous drainage of the subarachnoid space is difficult to assess, it is likely that the venous channels are a direct route of drainage Rapid removal by direct venous drainage would explain why concentration of penicillin in the cisterna magna is so low after the drug has been introduced in relatively large amounts into the subarachnoid space It would partially explain why the medullary centers are not paralyzed in patients subjected to spinal anesthesia

Oxygen and Carbon Dioxide Content of Arterial Blood before and during Spinal Analgesia. Using the Millikan oximeter and checking its accuracy by Van Slyke's manometric technic Kenneth E Latterell (Mayo Found.) and John S Lundy[4] (Mayo Clinic) made readings of oxygen saturation of arterial blood in 25 adults, most of whom were subjected to extra-abdominal operations. Premedication caused an average decrease of 1.5 per cent from an accepted normal oxygen saturation of arterial blood of 97 per cent. In no case did preoperative medication cause a practically significant degree of hypoxemia. Analgesia decreased the oxygen saturation of arterial blood only slightly the average being 95 3 per cent for 17 samples, as analyzed by the Van Slyke method Oximetric readings averaged 96 3 per cent.

(4) Anesthesiology 10 6 7-6?? November 1949

In no instance did the oxygen saturation decrease to less than 89 per cent during spinal anesthesia despite high levels of analgesia or severe decreases in blood pressure or both. Carbon dioxide content of blood samples taken before and during analgesia was within normal limits. These relatively minor changes indicate that respiratory depression resulting from intercostal paralysis due to spinal analgesia is slight and might be compensated for by increased excursion of the diaphragm. When respiratory depression and subsequent decreases in oxygen saturation of arterial blood occur they must arise from paralysis of the phrenic nerve or central respiratory depression due to analgesic drugs used.

Nausea during spinal analgesia was associated with decrease in blood pressure but not with a decrease in arterial oxygen saturation. If such nausea results from anoxia of the vomiting center it must be due to stagnant and not to anoxic anoxia.

[This article cannot be interpreted to whitewash the effect of spinal analgesia on the saturation of hemoglobin or the elimination of carbon dioxide because, although the oximeter measurements were reasonably dynamic, the Van Slyke analyses were spotty and infrequently associated with control analyses before the spinal analgesia. In addition, alterations in blood flow in the ear may have seriously influenced the readings of the oximeter.—Ed.]

Intrathecal Use of Vasoconstrictors to Prolong Spinal Anesthesia. In 631 blocks administered to 487 patients, John J. Bonica and Phillip H. Backup[5] (Tacoma, Wash.) compared use of epinephrine, neo-synephrine® and ephedrine in prolonging anesthesia. These drugs probably act by producing local vasoconstriction which delays absorption of the anesthetic from the subarachnoid space. Spinal anesthesia was used for general surgical procedures in most patients. Pontocaine® was the anesthetic agent, and a modified Sise technic the method.

Neo-synephrine® increased the duration of motor block 48 per cent, epinephrine 52 per cent and ephedrine 29 per cent. The duration of sensory block, as determined by the pin prick test, was increased 49 per cent with neo-synephrine®, 48 per cent with epinephrine and 22 per cent with ephedrine. Sensory block was subjectively increased 46 per cent with neo-synephrine®, 41 per cent with epinephrine and 14 per

(5) Northwest Med. 49:115-11, February 1950.

cent with ephedrine The drugs caused no significant variation in blood pressure, pulse or respiration, nor was there any increase in operative and postoperative complications. No neurologic complications or sequelae were observed

Complications of Spinal Anesthesia Evaluation of Complications Encountered in 5,763 Consecutive Spinal Anesthesias is presented by Clarence L. Hebert Carl E Tetirick and Joseph F Ziemba[6] (U S Marine Hosp , Staten Island) Most patients were relatively healthy male merchant seamen or civil service workers engaged in physical labor Standard technic of lumbar puncture essentially that of Lundy, was used Nervousness and apprehension, noted in 1 8 per cent were usually due to inadequate or ill timed premedication Nausea and vomiting, which occurred as an immediate complication in 6.3 per cent, may have been due to sudden change in position, emotional factors, increased muscular tone of the gastrointestinal tract with relaxation of the pyloric sphincter resulting from splanchnic nerve block or sudden blood pressure fall with cerebral anoxia.

Spinal anesthesia was too high in 5 7 per cent, probably because of speed of injection use of barbotage or volume or specific gravity of the injected solution Anatomic factors such as the caliber of the subarachnoid space, arachnoid adhesions and spinal curvature may have been important Inadvertent high spinal anesthesia was less with hyperbaric tetracaine hydrochloride (pontocaine®) dextrose ephedrine than with piperocaine hydrochloride (metycaine®) or procaine hydrochloride given in isobaric solution High spinal anesthesia may be managed with usual supportive measures for respiratory and circulatory disorders. Spinal anesthesia was inadequate in 1 7 per cent and ineffective in 0 7 per cent This may have been due to failure to place all the anesthetic in the subarachnoid space

Moderate blood pressure fall was noted in 7 per cent of the cases and pronounced fall in 4.2 per cent The fast action drugs such as procaine and piperocaine are more apt to cause blood pressure fall than is tetracaine Dextrose saline solution, up to 500 cc intravenously, may be used instead of vasoconstrictors in moderate hypotension Oxygen may be given routinely as a supportive measure

(6) J A M A 142 551 557 Feb. 25 1950

In the postoperative period a small percentage of patients complained of gastrointestinal disturbances hiccups and abdominal distention, but usually none of these could be related to the anesthesia Pulmonary infarct was reported in two patients, 1 per cent had respiratory infections and 0 6 per cent had atelectasis. Backache occurred in 1.83 per cent but persisted for more than two days in only five patients Relaxation of the lumbar muscles during anesthesia may be a causative factor and can be corrected by placing small pillows under the lumbar curve and beneath the knees. Urinary retention occurred in 3 per cent of the patients, but since 77 per cent had inguinal hernioplasty or appendectomy this incidence is not surprising Patients with benign prostatic hypertrophy are especially liable to urinary retention. Headache was reported by 6 43 per cent of the patients Headache due to cerebrospinal fluid hypotension is aggravated by the upright position, but early ambulation has not increased its incidence No severe neurologic complications were seen.

Relation of Neurologic Complications of Subarachnoid Block to Some Unseen Dangers of New Technics Marshall L Skaggs[7] (Stanford Univ) states that the accidental mixing of sterilizing solutions and anesthetic agent may be the cause of neurologic complications, such as cauda equina syndrome following spinal anesthesia Results of these complications range from paresthesia of short duration along one nerve root, incontinence of bladder or bowel to complete and permanent transverse myelitis Two patients noted a decided burning sensation when the spinal anesthetic agent was administered, and postoperatively permanent paraplegia developed in both. It is thought that alcohol or whatever antiseptic agent is used to sterilize the vials containing the anesthetic drug may have entered the ampule through small cracks or other microscopic openings in the glass due to imperfect sealing Since the antiseptic solutions used are colorless or only faintly tinged with a dye it is impossible to detect a mixture of the two fluids. To facilitate recognition of contamination antiseptic solutions should be colored a red so intense that as little as one drop will give a definite brilliant, permanent color when mixed with the

( ) California Med. 1 130 131 August 1949

contents of any ampule Another desirable characteristic of an antiseptic solution would be adherence to the outside of ampules, so that wiping with a moistened sponge and thus careful examination before use would be necessary

Early Effects of Spinal Anesthesia and Surgery on Blood Volume in Man were studied by Lawrence S Mann and Samuel I Guest[8] (Chicago Med School) Seconal,* morphine and scopolamine premedication with spinal pontocaine* glucose and intrathecal ephedrine anesthesia was employed. Pre and postoperative volume determinations were made, utilizing Evans blue dye Results for the various types of operation are shown in the table

The plasma volume showed no significant changes in most instances 10 minutes after anesthesia, but there was a rise one hour after anesthesia and surgery Blood volume showed insignificant changes 10 minutes after anesthesia but an increase in total circulating volume one hour after anesthesia. The latter may have been due to the effect of ephedrine No fluids were given during anesthesia and surgery, and blood loss was minimal since the operative procedures were not extensive

Dangers of Intrathecal Medication. George Wilson, Charles Rupp and William W Wilson[9] (Philadelphia Gen'l Hosp) have no doubt that intrathecal injections of drugs, anesthetics and antibiotics produce neurologic complications in many cases. Neurologic residuals are often serious, permanent, disabling and cannot be treated successfully Therefore, prevention is of prime importance

A history of some previous disease or injury involving the nervous system particularly the spinal cord, definitely contraindicates use of spinal anesthesia Spinal anesthesia may also precipitate the appearance of symptoms and signs of a latent neurologic disorder It is contraindicated in patients with congenital anomalies of the nervous system, with known virus infection and with a history of delayed return of motor function or severe paresthesias after a previous spinal anesthesia Conditions resulting in severe inanition and likely to be associated with vitamin deficiency are also probably contraindications even though there are

(8) Am J Physiol. 161 239 244, May, 1950
(9) J A M A 140 1076 1079 July 30 1949

Effects of Anesthesia (Spinal) and Surgery on Blood Volume in Man

Type of Operation	Age of Patient	Plasma Volume			Blood Volume			
		Before Anes.	10 Min. After	1 Hr After	Before Anes.	10 Min. After	1 Hr After	Elevation 1 Hr After
Arthrotomy	26	2 500	3 175	3 175	5,310	6,350	6,350	1 040
Bunionectomy	26	175	2 328	2,500	4 531	5 060	5 434	903
Osteotomy	24	2,400	2 500	2,593	4 615	5 952	6,173	1 558
Incision, drainage of foot abscess	54	3 240	1 500	4 000	5 603	6,230	7 142	1 539
Saphenous ligation	20	3,000	3 675	3 200	5,769	7 300	6,734	963
	31	2,700	2 500	2 930	6,428	6,410	7 564	1 136
Appendectomy	32	2,635	2 625	2 930	6 104	6,104	4 860	756
Skin graft (pinch)	54	2 000	2 235	2 500	4 444	4,358	4,901	457
Pilonidal cystectomy	27	2 575	3 050	2,975	5 597	6,636	6 467	870
Fusion of knee	35	3,000	3 075	3,250	6,250	6,406	6,770	520
Lumbar sympathectomy	51	2,850	2 525	2,930	4 730	4 855	5,673	923
	43	2,500	2 300	2,575	4 807	5,208	5,364	557
	68	2,775	2 677	3 000	5 336	5,249	5 282	546
	56	2,300	2 525	2 490	5 348	5 407	5,581	233
Inguinal herniorrhaphy	35	3 125	1,085	3,223	6 127	6,049	6,317	190
	28	2,725	2 812	2 700	5 677	6,248	6,000	323
	30	2,406	2 175	2 120	4,719	4 627	4,310	—209
	50	2,750	2,700	2 700	5,192	5 510	5 510	318
	36	2 590	2,500	2 700	5,255	5 102	5,510	255
	25	3 000	4 300	3 000	6,122	8 490	9 433	3,311
	53	2,283	2 128	2 300	4,221	4 476	4,807	586
	24	2,300	2 625	2,900	4,240	5 048	5,577	1,337
	41	2,210	2 865	2 500	4,243	4,530	5 000	757
	25	2,100	2 175	2 350	4,285	4 182	4 815	530
Inguinal herniorrhaphy & circumcision	33	3,125	2 800	2,800	5,712	5 937	5 927	215
Averages	37 5	2 652	2,750	2,904	5,236	5 686	6 012	776

no clinical neurologic symptoms before administration of the anesthetic

Intrathecal administration of sulfonamide compounds, penicillin and other therapeutic agents with which adequate therapeutic concentrations can be obtained by systemic administration is strictly contraindicated More extensive studies are necessary to ascertain whether adequate therapeutic cerebrospinal fluid concentrations of streptomycin are obtained from systemic administration alone The literature contains considerable evidence of the toxic effect of these drugs following intrathecal administration.

Before any intrathecal injections are made the benefits to be derived must be weighed against the potential hazards *Adequate neurologic history and examination should* be completed for every patient considered for spinal anesthesia. Another anesthetic should be chosen if any abnormalities are observed or history of previous neurologic disorder elicited

[Although not contraindicating use of an acceptable and useful anesthetic technic, the three preceding articles are representative of others and may have a sobering influence on the enthusiasts. The lack of "severe neurologic complications" in the cases reported by Hebert and his associates can only mean that sufficient cases were not included or that there was a liberal interpretation of "severe."—Ed.]

Comparison of Malleable Needle and Catheter Technics for Continuous Spinal Anesthesia has been made by Robert D Dripps[1] (Univ of Pennsylvania) The malleable needle method was used 1,107 times and the catheter procedure 506 times Table 1 indicates that the catheter technic was less dependable

The commonest problems with a malleable needle were displacement of the needle tip from the subarachnoid space and inability to insert the needle properly Displacement can probably never be avoided entirely but in 23 of 41 cases satisfactory readjustment of the needle position was possible In 26 of the 28 occasions when the malleable needle could not be introduced satisfactory anesthesia was obtained by substitution of a rigid German silver needle

The most frequent difficulty of the catheter technic was absence of anesthesia or an inadequate degree of block The major cause for failures was that the distal end of

(1) New York State J Med 11 1595 1599 July 1 1950

the catheter did not lie within the subarachnoid space An esthesia will rarely be satisfactory if cerebrospinal fluid cannot be obtained from the catheter after withdrawal of the needle In a few instances fluid could be withdrawn or dripped from the catheter yet injection of various types of anesthetic solutions provided little or no block.

Table 2 compares the incidence of complications with a rigid (20 gauge) needle a malleable (19 gauge) needle and the combination of the Huber point (16 gauge) needle and

TABLE 1—NUMBER OF TECHNICAL PROBLEMS

	Problems		Absolute Failure	
	No	%	No.	%
...gle dose (1,921)	57	3.0	28	1.5
...lleable needle (1,107)	101	9.0	33	3.0
...heter (506)	78	15.0	43	8.5

TABLE 2—TRAUMA DURING INDUCTION

	Single Dose		Malleable Needle		Catheter	
	No.	%	No.	%	No.	%
...taps	42	2.2	16	1.4	22	4.4
...esthesias	244	13.0	61	6.0	170*	33.0

103 needle 65 catheter

catheter It is evident that the catheter technic causes more local trauma The lower incidence of trauma with the malleable needle may be due to the fact that most of these administrations were done by two physicians who became more skilled as their experience enlarged

Continuous spinal anesthesia should be used less frequently Supplemental general anesthesia or longer acting local anesthetic drugs make continuous procedures of less importance Malleable needle or catheter technics may have merit for operations of greater duration than three to four hours particularly when muscular flaccidity is required for a successful conclusion.

Technic of Administering Epidural Anesthesia in Thoraci[c] Surgery William W Buckingham Arch J Beatty Charles

A. Brasher and Poul Ottosen[2] (Missouri State Sanatorium) have used this procedure successfully in 617 thoracic surgical operations

There are numerous advantages in this type of anesthesia for thoracic surgical cases The cough reflex is preserved, permitting constant evacuation of bronchopulmonary secretions Maximal oxygenation is possible with minimal deviation from normal status Electric cautery can be used without danger of explosion. Because of paralysis of the thoracolumbar sympathetics the body remains warm and dry, with minimal fluid loss, thus preserving its normal electrolyte balance There is less loss of blood and less capillary bleeding than with other types of anesthesia All types of thoracic procedures can be performed. Concentration of the anesthetic after introduction into the epidural space provides maximal sensory analgesia and minimal motor paralysis. Since the epidural space which lies between the dura mater of the spinal cord and the bony fibrocartilaginous boundary of the vertebral column is limited at the foramen magnum, the analgesic solution cannot reach the vital medullary centers The drug does not enter the subarachnoid space where the nerve roots and cord are unprotected. In 33 cases nitrous oxide anesthesia was well tolerated as a supplement to the epidural anesthesia.

The following are possible disadvantages The technic of administration is somewhat difficult but can be mastered through observation and experience The psychic factor of being operated on while awake is distressing to some patients, although many fear going to sleep during surgery Procaine or pontocaine® sensitivity may be involved but can be avoided by skin testing the day before surgery

[There is no question of the advantages of the epidural technic for anesthesia for thoracic, particularly extrapleural, surgery However the authors neglect to outline any method for assisting the patient in compensating for the pronounced changes in dynamics of respiration and circulation that often accompany an incised chest.—Ed.]

(2) Dis of Chest 17 561-568 May 1950

Preanesthetic Medication for Children has been studied by James S West and E M. Papper[3] (New York Univ) in 222 children who were subjected to tonsillectomy and adenoidectomy Vinethene* induction was followed by open drop ether in all patients until operation was begun, when air insufflation of ether without an endotracheal airway was instituted Scopolamine or atropine was given in doses of 0 0002 Gm for patients aged 2-5 0 0003 Gm. for ages 6-10 and 0 0004 Gm. for ages 11 14 Neither the surgeon nor the anesthesiologist knew which drug had been administered. Scopolamine was given to 153 patients and atropine to 69 In the scopolamine group results were good in 73.2 per cent fair in 17 6 per cent and poor in the remainder In the atropine group results were good in 49 3 per cent, fair in 30 4 per cent and poor in 20.3 per cent

Maximal benefit with either atropine or scopolamine was observed when the drug was administered 31 60 minutes before induction of anesthesia. A sedative action was common after scopolamine and rare after atropine Larger doses of belladonna drugs than are usually recommended for children were found to be safe

New Analgesics—*Methods in Clinical Evaluation* Jane E Denton and Henry K. Beecher[4] (Harvard Univ) state that appraisal of analgesics should be made by investigators who can devote their entire attention to it, for the process is time consuming The subjects to be utilized in testing new narcotics must be carefully screened to prevent mishaps All drugs must be dealt with as unknowns to eliminate bias and prejudice on the part of observers who collect the data A standard such as morphine and a control such as sodium chloride solution must be used for appraisal of analgesic potency Criteria for grading extent of relief should be practical and well defined Relative analgesic potency of a new drug should be determined in a definite range of the dose-effect curve of that drug and for the

(3) Anesthesiology 11 2 9 82 May 1950
(4) J A M. A. 141 1081 105 Dec. 10 1949

standard. Each patient should receive the same number of doses of a given drug whether there is complete or no relief. Side action potency must be determined on the basis of equivalent analgesic doses Psychologic variability is probably the most important factor to eliminate in selecting subjects Conclusions depend not only on objectivity, accuracy and quantity of data but also on adequate statistical analysis

Clinical Appraisal of Narcotic Power of Methadone and Its Isomers—In a study of 429 postoperative patients, Denton and Beecher[5] evaluated analgesic power and side action lability of morphine and d,l methadone l methadone, d,l isomethadone and l isomethadone Age sex distribution and types of operation in the group were comparable Morphine and d l methadone were found equivalent in analgesic potency but in comparison that of l methadone was approximately twice as great d l isomethadone was only about one third as potent as morphine, but l isomethadone was equivalent to morphine in analgesic power There were no clinically significant differences between morphine and the methadones with respect to speed of action and duration of effect

Because it was impossible to differentiate in postoperative patients the side effects of the drugs from after-effects of anesthesia and surgery side effect studies were carried out in healthy volunteers. With the exception that l isomethadone produced less nausea than morphine in the 28 subjects studied, symptom production and duration were similar when comparable analgesic doses of morphine and methadones were administered The effects of methadones on slowing the pulse and depressing respiration were similar to that of morphine Neither systolic nor diastolic blood pressures were altered by the drugs

[Although there is room for debate on the details of the technic used, the authors present a method that helps provide objective evidence in clinical investigation, an approach to the evaluation of drugs that is used too infrequently Clinical investigators will do well to consider the principles outlined.—Ed.]

Morphine Sensitivity William T Salter and Mary Louise White[6] (Yale Univ) state that the term sensitivity

(5) J A M A 141 1146-1153, Dec. 17 1949
(6) Anesthesiology 10 553 561 September 1949

should be reserved for purely allergic phenomena. In a patient sensitized to morphine its administration is equivalent to administration of an antigen. Symptoms of acute allergy may develop ranging from minor syncope to grave anaphylactic shock complicated by severe bronchial asthma.

Other phenomena referred to as manifestations of "sensitivity" might better be called hyper reactivity with respect to certain functions. Such is the profound depression from morphine which occurs in certain patients with hypothyroidism or Addison's disease. Apart from such endocrine disturbances there is a problem of excessive reactivity from various causes not yet ascertainable. This phenomenon probably represents the normal reactivity of a random population and indicates that the routine dose is but an approximation. To be sure it is not based on any sound biometric measurement in the individual case.

Another phenomenon is the maniacal reaction characteristically shown by cats and some women. Instead of becoming depressed the subject shows something similar to an alcoholic jag with excitement so intense as to be alarmingly exhaustive. The highly neurotic patient may respond to morphine with restlessness, sleeplessness and even confusion instead of with depression. A common effect of morphine is vomiting, especially postoperatively. Occasionally a severe fall in blood pressure may occur followed by severe circulatory collapse. Closely related to nausea is the fainting produced by morphine, especially that precipitated by a sudden change in position. After subcutaneous or intravenous use of morphine in certain persons and especially in children, a reddened cord of lymphangitis may appear on the forearm. The precise mechanism of this disturbance is unknown but it may represent a direct irritative effect of the drug on the endothelium of the large lymphatic channels. Another effect of morphine is the synergism which may occur when it is administered simultaneously with agents such as scopolamine. A profound depression may ensue which would not have occurred had the same dose of morphine been given alone. Instead of involving the cerebral cortex primarily, morphine may affect the respiratory center more profoundly when codeine is used freely in advance of morphine.

At the extremes of life there is increased reactivity to morphine which is difficult to explain Old people and patients who have suffered emaciation and cachexia from prolonged disease are peculiarly susceptible to large doses of morphine Suckling animals have shown an increased susceptibility to morphine

Nausea and vomiting occurring after morphine is given may be due to direct stimulation of the medulla which precedes the depression An easy way to circumvent these effects is to avoid using morphine When morphine is really needed the safest procedure is to give small repeated doses, in combination with synergistic cortical depressants such as scopolamine A dose of 8 mg or less may be given an hour before the usual time and repeated after 40-50 minutes in an appropriate amount depending on the patient's preliminary reaction True allergic sensitivity to morphine can be combated with epinephrine Other common causes of unexpected reaction may be avoided by due attention to the individual patient in judging doses Incidence of postoperative vomiting can be reduced by assuring proper oxygenation during anesthesia

Effects of Large Doses of Barbiturates and Morphine and *Scopolamine on Respiratory Minute Volume Exchange* Howard A. Bennett (Univ of Oklahoma) Charles E Gray and Stuart C Cullen[7] (State Univ of Iowa) state that with heavy premedication nitrous oxide and ethylene can produce good first plane anesthesia without reduction in oxygen concentration to undesirable levels Observations were made on 30 patients undergoing surgery of a superficial nature which required little or no relaxation and was of fairly long duration. For healthy persons aged 12-60 premedication included pentobarbital 180 mg morphine 10 mg and scopolamine 0 43 mg for those aged 60-75 pentobarbital 90 mg morphine 8 mg and scopolamine 0 33 mg were given. Pentobarbital was given orally 2 hours, and morphine and scopolamine hypodermically 1½ hours, before induction. If necessary all medication was given intravenously 20 minutes before induction

The postmedication mean tidal volume was 67 9 per cent of the control mean and the mean during anesthesia was

(7) Anesthesiology 10 548 552 September 1949

60 1 per cent of control, indicating a significant reduction in tidal volume Variation of the minute volume exchange also showed a reduction, but to a lesser extent. It was clearly demonstrated that respiratory depression as reflected in tidal volume was in part compensated for by an increase in respiratory rate All data were proved statistically significant.

Clinically this method of administering nitrous oxide or ethylene is tolerated by almost any type of patient but is particularly adaptable to the elderly poor risk patient Neither induction nor awakening from anesthesia was noticeably retarded due to reductions in tidal volume or minute volume exchange Both agents produced a minimum of physiologic changes when administered with ample oxygen. The more profound physiologic deviations associated with prolonged administration of cyclopropane or ethyl ether are reduced. Most patients are in full possession of their reflexes on leaving the operating room and can respond to vocal instructions shortly after anesthesia has been discontinued. Nausea and emesis postoperatively are extremely infrequent. If the surgical procedure is shorter than anticipated the patient will return to his room in a moderately depressed state, but this can be avoided by careful patient selection.

Metabolic Fate of Pentobarbital Isotope Dilution Experiments with Urine after Administration of Labeled Pentobarbital were conducted by E W Maynert and H. B Van Dykes (Columbia Univ) The urine of four dogs given anesthetic doses of pentobarbital labeled with N^{15} contained an average of 82 per cent of the drug in the first 24 hours. In three dogs between 5 and 10 per cent of the N^{15} was excreted as urea, but the other animal excreted almost none in this form. Only negligible amounts of ethyl (1 methyl butyl) malonuric acid and the corresponding acetyl urea, acetamide and malonamide were present in the urine as metabolites of pentobarbital. The excretion of such compounds may be attributable largely to coprecipitation. These negative results do not prove conclusively that hydrolysis of pentobarbital does not occur in the body

(8) J Pharmacol. & Exper Therap. 98 174 179 February 1950.

Males and Females as Anesthetic Risks Postoperative pulmonary complications encountered by Torsten Gordh[9] (Stockholm) in 428 patients having cholecystectomy included cough in 6, bronchitis in 6 atelectasis in 3, broncho-

ANALYSIS OF DATA ACCORDING TO SEX

	CHOLECYSTECTOMIES		GASTRIC RESECTIONS	
	Male	Female	Male	Female
Cases	130	298	162	60
Per cent	31	69	73	37
Average age	61	56	56	54
Average risk	2.2	1 9	1.9	2.2
Anesthetic period satisfactory %	50	65	46	65
Postoperative complications				
Respiratory	11.5	3.6	15 4	8.3
Circulatory	7.0	3.0	8.0	5.0
Genitourinary	14.0	19 0	11.1	21.1
Deaths	6	0	8	0
Per cent	4.6	0	4 9	0

pneumonia in 12 and pleuritis in 1 The age of 50 was exceeded by 61 per cent. Spinal anesthesia was the primary method in 55 per cent intravenous anesthesia in 40 per cent and ether in the remainder Only 60 per cent of anesthesias were considered satisfactory Respiratory complications were encountered in 20 6 per cent given intravenous anesthesias and 2 1 per cent given spinal Circulatory complications occurred in 17 1 per cent and 34 2 per cent respectively and gastrointestinal troubles in 7 6 per cent and 0 6 per cent

Of 222 patients having gastric resection 53 per cent were over age 50 Postoperative pulmonary complications occurred in 18 5 per cent and included cough in 8 bronchitis in 6 atelectasis in 1 bronchopneumonia in 14 and pleuritis in 1 Circulatory complications were found in 7 2 per cent and included fall in blood pressure in five internal hemorrhage in three thrombosis in three pulmonary emboli in

(9) Proc. Roy Soc. Med. 43 367-371 May 1950

four and heart failure in one Other findings were similar to those in the first group

The main causes of death in both series were paralytic ileus in five pulmonary emboli in two peritonitis in three and hepatorenal syndrome heart failure bronchopneumonia and cachexia in one each Because all deaths occurred in males a comparison of data by sex was made The table presents this analysis revealing that males are a poor risk and more susceptible than females to anesthetic and post operative complications

Trichloroethylene as Inhalation Anesthetic and Analgesic

C Langton Hewer[1] (St Bartholomew's Hosp, London) states that one of the chief advantages of trichloroethylene is that it is not inflammable It is extremely useful for producing analgesia with retention of consciousness and is extensively employed for this purpose in obstetrics and dentistry A concentration of about 0 5 per cent in air is sufficient It is unwise to use this agent alone to produce complete muscle relaxation

There is usually no significant change in the blood pressure under trichloroethylene narcosis Capillary oozing from wounds is less than with ether and cyclopropane Multifocal ventricular tachycardia has been demonstrated in about 10 per cent of cases, but reports of primary cardiac failure due to the drug are rare

Trichloroethylene has slight irritant effects on the respiratory passages but there is no excessive salivation or increase in mucus The respiratory rate rises as the depth of narcosis increases until muscle relaxation is complete when tachypnea may be extreme For this reason the drug is unsuitable for production of deep narcosis

As judged by cephalin flocculation tests trichloroethylene causes less liver damage than chloroform or ether It is generally used as a supplement to nitrous oxide and oxygen It should not be administered with soda lime in a closed system because of the danger of cranial nerve palsy A semiclosed apparatus is the best means of administration.

[This is a drug which is used extensively in Great Britain and other countries of the continent with satisfaction. The author has had extensive clinical experience and his observations must be heeded. However there is

(1) Canad M A J 62 324 32 April 1950

ample evidence to indicate that the effect of trichloroethylene on the heart is equally as hazardous as that of chloroform and liver damage is not as remote a possibility as is implied.—Ed.]

Detection of Explosive Mixtures or Static in Operating Rooms J W Uhl, H. M Livingstone and K. S Ting[2] (Univ of Chicago) have been able to detect combustible anesthetic mixtures by using the principle of the Wheatstone bridge The Vapotester contains a balanced electric circuit with two

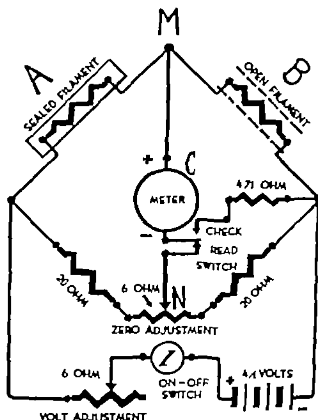


Fig 189 (Courtesy of Uhl, J W et al Anesthesiology 10 479-483 July 1949)

legs (Fig 189, *A* and *B*) which are incandescent platinum elements or filaments. Filament *A* is housed in a completely sealed chamber while filament *B* is so arranged that a sample of air can be drawn through it. Current to the circuit is supplied by six no 2 flashlight cells. Flashback arresters are in the inlet and outlet fittings of the sampling circuit. When a combustible gas-air mixture is drawn into the open chamber containing filament *B* it readily ignites and in

(2) Anesthesiology 10 479-483 July 1949

creases the temperature of the platinum filament This in crease in turn increases the resistance of filament *B* resulting in an unbalanced circuit with varying potential at points *M* and *A* which allows the current to flow through the meter *C* The meter is graduated against explosibility and may be read directly in percentage by the lower explosive range The meter is calibrated for hexane but actual percentage by volume of individual anesthetic mixtures may be easily determined with conversion curves Nitrous oxide-oxygen mixtures cause the needle to deflect to the highly explosive range since the temperature of the filament is about 650 C., sufficient to bring about decomposition of nitrous oxide

The Statometer is a battery-operated instrument especially designed to detect the presence, source and intensity of static electricity and is therefore useful when combustible anesthetic mixtures are administered. Two ranges permit measurement from 0 to 1 volt and from 0 to 1,000 volts. When the instrument is near a body charged with static electricity its needle will be deflected from 0 indicating the presence of static electricity As the instrument is brought closer to the source of static electricity the needle will be deflected higher on the meter The principle is essentially that of an inverted vacuum tube which has been coupled with a sensitive pentode tube circuit so that both may function as one tube By introducing a three circuit switch into the system, the transition from the inverted tube circuit to the pentode tube circuit is easily accomplished, thereby giving the instrument a low voltage and a high voltage range

Laryngeal Granulomas Following Intratracheal Anesthesia Simon Jesberg and Norman Jesberg[3] (Los Angeles) report two cases in which granulomas followed pernasal tracheal intubation suggesting that trauma at the time of blind catheterization of the trachea was the cause The initial lesion may be an ulcer of the mucous membrane or subepithelial hemorrhage Such a focus of irritation may develop into a soft, fleshy polypoid mass Lesions may be bilateral, and the favorite site of attachment is at or near the vocal process of the arytenoid cartilage Hoarseness, the usual symptom may not develop for two to four months

3) California Med. 71 398-399 December 1949

postoperatively In most instances diagnosis can be established by indirect laryngoscopy Removal with a suitable forceps under direct laryngoscopy is the treatment of choice

[One may justifiably debate the cause and effect relationship of intubation and laryngeal granulomas and the associated incidence but one can afford to ponder on it and exercise care and conservatism in the use of the endotracheal technic in anesthesia.—Ed.]

Electromechanical Aids in Resuscitation and Anesthesia An apparatus described by Kenneth Wolfe and H. J Rand, III[4] (Cleveland) comprises vacuum cup electrodes to aid in providing an effective heart beat by massage and a controlled electric shock device for shocking the fibrillating heart to a standstill so that it can resume a normal rhythm. Before a heart can be defibrillated successfully it must be massaged until much of the dilatation is eliminated, until a good tone replaces the flabby myocardium and until the color becomes pink showing that oxygenated blood is circulating through the heart. Hand massage may be inadequate and may not bring about these conditions.

The massage apparatus operates on 110 volts a c Vacuum cup electrodes each with its own vacuum pump and associated controls to adjust suction to the exact amount necessary are placed on opposite sides of the fibrillating ventricles. About 5 in. vacuum has proved satisfactory on the dog heart The adjustment is made with the cups in contact with the ventricular wall and the heart massaged vigorously at a slower than normal rate so that it can fill and empty as in life In a few seconds it becomes pink with oxygenated blood

When the heart is ready for shock the power switch is turned on and a buzzer and pilot light inform the surgeon that the apparatus is ready for use The autotransformer and variable resistor are adjusted to deliver approximately 1 amp through the heart A voltmeter and ammeter are included to indicate voltage and amperage The surgeon can administer the shock by means of a switch on the handle or an assistant can use a switch on the instrument panel itself

If the initial shock is unsuccessful, massage is re eated procaine is used on the surface and in the ven nd a second shock is given at a s tly higher cur di

(4) Ohio Stat M J 46:39-40

tional shocks are necessary the current is increased gradually with each until a maximum is reached. When the normal heart beat returns it is aided by gentle massage and stimulated by injection of epinephrine If necessary a mechanical respirator is used to provide artificial respiration until normal respiration returns

Supportive Therapy during Anesthesia and Operation. According to Thomas H Seldon[5] (Mayo Clinic), the clinical picture is much the same whether failing circulation is due to trauma, extensive operative procedure or hemorrhage In recognizing shock the skin color is a useful criterion it may be pale pink or cyanotic A rapid estimate of fluid loss in hemorrhage, sweating vomiting urine and feces is important. Examination of blood for hemoconcentration or hemodilution is not of great value but estimation of blood volume is more reliable The more rapid the pulse the poorer the circulation, and if it is imperceptible at the wrist it may be necessary to palpate the carotid artery Such irregularities as extrasystoles, alternating pulse and fibrillation may indicate severe disturbance of the blood supply to the heart Though blood pressure is important for evaluating the circulation, it is possible to have a considerable loss of blood volume and yet have a blood pressure within reasonably normal limits. It is not possible to select an arbitrary level which would always indicate the presence of shock. The hypertensive patient may be in serious condition when his blood pressure declines to levels ordinarily considered normal.

Too much emphasis should not be placed on information obtained from laboratory procedures. Clinical examination by a competent physician should play an important part in planning treatment Blood volume measurement by injections of Evans blue dye erythrocyte count hematocrit reading serum protein determination with estimation of the albumin/globulin ratio nonprotein nitrogen and carbon dioxide-combining power may all be of some value

Most deaths occurring during anesthesia are due to failure of the circulation or of the respiratory mechanism The cause may be (1) obstruction of airways (2) carotid sinus reflexes, (3) method of administration of procedure (4)

(5) J A M A 141 12 9 1284 Dec. 31 1949

direct effect of anesthesia on respiratory mechanism or (5) direct effect of anesthesia on circulatory system Anoxia or hypoxia during anesthesia is a factor in circulatory failure

The underlying principle of supportive treatment of any patient undergoing surgery is to prevent a disparity between the circulating blood volume and circulatory bed in which the blood flows. The surgeon should handle tissues gently and seek to prevent loss of blood and plasma The anesthesiologist should prevent circulatory embarrassment by replacing fluid as required

Certain general measures are important in treatment of shock. The patient should be placed in a head-down position Compression bandages on the extremities decrease venous pooling, improve muscle tone and help increase peripheral resistance The body should be maintained at normal room temperature, avoiding excessive heat or cold If pain is one of the agents precipitating a disturbance of the circulatory blood volume, pain relieving drugs may be used, but morphine is contraindicated. Small doses of barbiturates may be given orally or intramuscularly Gentle, orderly and quiet treatment of the patient is essential. In the early stages of secondary shock vasoconstrictor drugs may raise the blood pressure above the critical level and aid in a more rapid recovery Early administration of oxygen is of real value

Restoration of blood volume is the most important single item in the treatment of impending or existing shock *Blood* volume may be decreased at least 20 per cent before clinical shock is apparent A systolic blood pressure of less than 85 mm. Hg usually indicates a loss of blood volume of at least 25 per cent. Although blood substitutes and blood derivatives may be available whole citrated blood is the best replacement fluid for patients with impending or existing circulatory disturbances, particularly if there is hemorrhage. If whole blood is not readily available plasma will aid in keeping the patient alive Initial doses should be large, 500 cc or more, and if adequate the systolic pressure will rise 10-25 mm Hg However, whole blood should be administered, especially when blood loss is the major cause The patient's response to treatment should be used as a

guide to the amount of fluid or blood to be administered. A good response is signified by return of blood pressure to normal range slowing of pulse rate, increase in blood volume, decrease of peripheral vasoconstriction and a return to normal cardiac output Other clinical evidences of good response are increased alertness of the patient, warm skin, improved output of urine and radial pulse of much better quality Failure to respond is frequently the result of inadequate administration of blood or blood plasma and may be associated with poor improper or inadequate observation and treatment.

Scientific Aspect of Endotracheal Tubes E B Macon and H. D Bruner[6] (Univ of North Carolina) attempted to determine the smallest tube which will support adequate respiratory exchanges under anesthetic conditions In breathing through tubes the flow is partly laminar the paths of the molecules lying parallel to the direction of the tube and partly turbulent the paths being in any direction, depending on the stage of the respiratory cycle For turbulent flow to deliver an increased volume the pressure

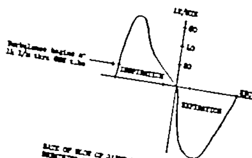


Fig 190 —Three second respiratory cycle. (Courtesy of Macon, E. B. and Bruner H. D Anesthesiology 11 313-320 May 1950)

must be increased to a greater extent than in laminar flow In laminar flow viscosity but not density is a factor but in turbulent flow the reverse is true Helium and oxygen have similar viscosities but dissimilar densities Nitrous oxide and cyclopropane have similar densities and dissimilar viscosities.

(6) Anesthesiology 11 313 3 0 May 1950

Figure 190 shows diagrammatically the intermittency of respiration and table 1 demonstrates the necessity for increased pressure as turbulent flow develops Figure 191 shows the tubes tested table 2 lists their specifications and Figure 192 depicts measurements obtained with them The 7.5 mm tube was not used in the experiment Data which aid in selection of a proper tube are listed in table 3

If the internal surface of a tube is rough it will throw the gas into turbulent flow more quickly than if it is smooth.

TABLE 1—FACTORS BY WHICH INITIAL PRESSURE MUST BE MULTIPLIED AS TUBE SIZE IS DECREASED FROM 10 MM

TUBE SIZE, MM	LAMINAR FLOW	TURBULENT FLOW	FLOW LAMINAR PART OF TIME, TURBULENT PART OF TIME
10	1.000	1.000	1.0
9	1.524	1.694	1.6
8	2.441	3.0ͅ2	2.7
7	4.165	5.950	5.0
6	7 716	12.860	10.3
5	16.000	32.000	21.0

TABLE 2.—TABULATION OF PHYSICAL MEASUREMENTS OF TUBES IN FIGURE 2

TUBE NO.	LUMEN RADIUS, MM	LENGTH MM	CROSS AREA, MM	VOL., MM³	CIRCUMFERENCE, MM	TOTAL INNER SURF AREA, MM
1 Woven	1.25	216	4 91	1,060	7 85	1,700
straight	2.25	184	15 90	2,910	14 10	2,600
2 b curved	2.25	184	15 90	2 910	14 10	2,600
c short	2.25	100	15 90	1,590	14 10	1 410
3 Woven Foregger 26	3.35	283	35 25	9 990	21 05	5,960
4 Woven Foregger 32	3 95	285	49.00	13 970	24.81	7 060
5 Woven Foregger 38	4 75	285	70.90	20 100	29 85	8,500
6 Woven Foregg 40	5 15	285	83 30	23,740	32.15	9,220
7 Rubber	3 40	215	36.30	7 800	21 36	4,590
8 Rubber Foregger 32	4 00	385	50 10	19,350	25 15	9 680
9 Rubber Foregger 35	4.50	390	63 60	24 800	28.28	11 050
10 Rubber Foregger 38	4 65	375	67 90	25 450	29.22	10 900
11 Rubber Foregger 40	5 00	375	78.60	2 947	31 4	11,800
12 Large Connell Airway	23 × 2 58	108	59 40	6 417	51 16	5,525

Same tube, but bent at right angles as in throat radius of curvature—38 mm.

In tubes of 6-8 mm. internal diameter the ratio of millimeters in diameter to liters/minute is about 1 5 5 at 5 mm pressure A quick calculation is thus available Length of tubes is a minor factor Figure 190 illustrates the necessity for increased pressure at the peaks of both types of breathing The exhalation valve on the Connell machine can be placed at 6 mm Hg and as shown in Figure *192* even with the no 3 tube of 6 7 mm diameter pressure of less than

5 mm Hg is needed to supply up to 85 L/minute In other gas machines, when the bag is moderately distended the pressure is approximately right With tube no 3 the maximal flow obtained under pressure of 15 mm Hg (which

TABLE 3*—ANTHROPOMETRIC DATA

Age, Yr.	Rate (after Feer)	Tidal Vol. Cc. (after Gregor)	Computed Min Vol., Cc.	Weight Kg.	Ventilation Vol./Kg. Cc.
Birth	40-45	27	1,080-1,215	3.0	360-405
1	25	48-100	1,200-2,500	?	?
2	24	85-129	2,040-3,096	7.0	291 258
3-7	20	124-221	2,480-4,420	14.8-19.0	166-232
8-14	18	221 395	3,978-7,110	22 29	180-244
Adults	16	500	8,000	70	144

* Henry Laurens from Brennemann's *Practice of Pediatrics* (chap. 38, vol. 2, p. 5)

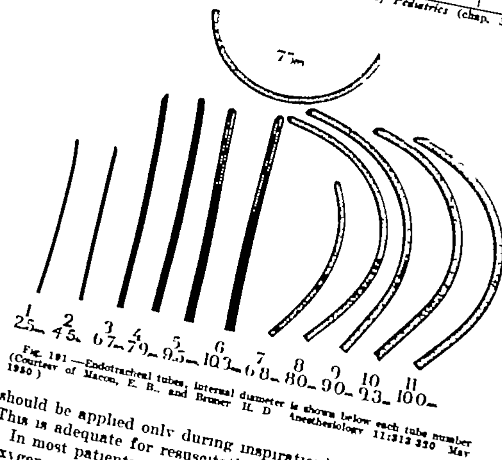


FIG. 191—Endotracheal tubes, internal diameter is shown below each tube number (Courtesy of Macon, E. B., and Bruner H. D Anesthesiology 11:313-320 May 1950)

should be applied only during inspiration) is 60 L/minute This is adequate for resuscitating the apneic patient

In most patients when 80-95 per cent oxygen is used, the oxygen content of the blood is raised at least 10 per cent

as nitrogen is displaced Absence of muscular activity and the low metabolic rate owing to premedication and anesthetic are important influences on oxygen demand Intubation decreases physiologic dead space by 50 cc and mechanical dead space by 150 cc., adding to efficiency of respiration. To insure usage of the proper tube each should be labeled with the inside diameter This can be done on

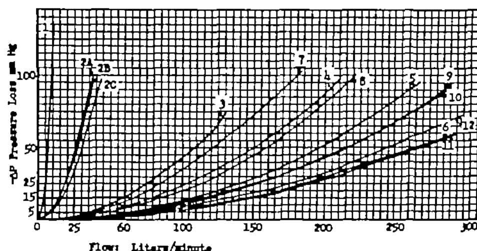


Fig 192—Horizontal lines represent manometric measurements of gas pressure and vertical lines, flow rates; lines indicating pressure of 5 and 15 mm. Hg are heavy as are also vertical lines indicating rates of flow of 25 L./min. and 60 L./min.; 5 mm. line represents pressure which could be safely continuous, 15 mm. line represents pressure which could be safely intermittent. (Courtesy of Mason, E. B., and Bruner H. D Anesthesiology 11 313-320 May 1950)

rubber tubes by writing with 50 per cent solution of silver nitrate Tube cuffs should not be inflated unless necessary for they may constrict the tube and traumatize

Experiments on Intravascular Administration of Oxygen and of Helium. *The observations of* Willard E Goodwin and Merel H. Harmel[7] (Johns Hopkins Univ) were made on dogs given intravascular injections at rates of 0.20-0 90 cc./kg body weight/minute for 30-60 minutes

PROCEDURE.—The most practical device for introducing oxygen or helium into the blood stream was a ureteral catheter with the distal end denuded of shellac and plugged leaving a considerable surface for the delivery of a large number of small bubbles through its close, finely woven fabric. The device (Fig 193) used to control the flow of gases into the blood vessels was patterned after that designed by Ziegler Gas passed from the tank to a Foregger wet flowmeter of

(7) Anesth. & Analg. 28 255 268 Sept.-Oct., 1949

the Bernoulli type, then through a bacterial filter and a small column of water and then through a small container of sodium hydroxide. A mercury manometer was attached to measure resistance. The Foregger flowmeter was accurate to within 3 per cent. Denitrogenation of the dogs' blood was accomplished by permitting them to breathe pure oxygen for about 30 minutes, then a hypoxic mixture (helium 88 per cent, oxygen 12 per cent) for at least 20 minutes.

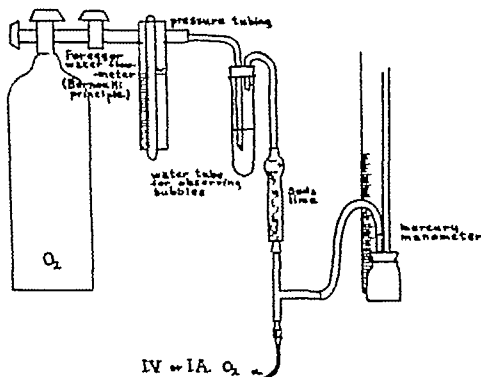


Fig. 193—Device for controlling flow of gases into blood vessels. (Courtesy of Goodwin, W. E., and Harmel, M. H. Anesth. & Analg. 28 256 263 Sept.-Oct., 1949.)

This denitrogenating procedure has apparently not been used by other workers in this field. The animals were healthy mongrel dogs and all had been given intraperitoneally 32 mg sodium pentobarbital/kg In 21 experiments 10 dogs were used.

Results were of the same general nature whether oxygen or helium was injected intravenously or intra arterially Similar respiratory rate increases followed arterial and intravenous administration of oxygen. However, when oxygen was directed into an artery respirations were deeper and less urgent The increase in respiratory rate was less in animals breathing air Onset of tachypnea was somewhat slower when oxygen was given by artery than when oxygen was administered by vein or helium by artery The

per cent were aged 30-69 Semiclassical music was requested by 55 4 per cent, and 31.9 per cent desired popular music. Continuous spinal and local anesthesias were most frequently used and major surgery was performed in 78 per cent Vagotomy for peptic ulcer was performed in 24 instances, these patients were excellent candidates to receive the calming influence of music since most of them were tense and nervous in normal situations.

The reaction of 76 4 per cent was enthusiastic, 11 8 per cent were mildly enthusiastic, 6 4 per cent indifferent and 5 4 per cent disliked music during the operation. Selection of the correct type of music was important It must be a melody that will calm and sooth the patient, not excite or stimulate him, yet it must hold his attention. This is directly opposite the effect desired in playing music for workers in industry

[A rather pronounced and distressing tendency is exhibited among surgeons and anesthetists to take the "easy way" and subdue their apprehensive patients with drugs which, although effective, may be detrimental. The spoken word and music may be equally beneficial and distinctly less poisonous —Ed.]

Stages of Anesthesia New Concept O Schmahmann[9] (Univ of Witwatersrand) states that the stages of anesthesia with procaine administered intravenously do not conform to Guedel's classification. Lack of consideration of sensitivity to the anesthetic agent is a major factor in the difference In addition to the usual signs and symptoms of anesthesia there are symptoms of sensitivity due to variation in dosage and variation in the occurrence of reaction.

Most symptoms of reaction sensitivity take the form of stimulation and usually herald a convulsion Although depression and coma may occur they usually *follow convulsions* or other manifestation of excessive stimulation. Reaction sensitivity varies considerably from patient to patient, but in the same patient it varies only slightly from day to day depending mainly on speed of injection. Factors that affect a patient's normal reaction sensitivity include fear excitement apprehension, fever pain and endocrine imbalance Children are more liable to overstimulation than adults and have greater reaction sensitivity

(9) South African M. J 24 49 52 Jan. 28 1950

The striking variation in amount of anesthetic agent required to produce identical degrees of anesthesia in different patients may be referred to as dose sensitivity. This variation is greater with procaine than with other anesthetics. The dose which produces analgesia in one patient may produce anesthesia in another and constitute gross overdosage in a third. The increase or decrease in dosage is accompanied by corresponding change in the time required for production of anesthesia. The same factors which influence reaction sensitivity influence dose sensitivity.

Application of this concept to Guedel's classification indicates that excitement, fear or increase in the basal metabolic rate produces an expansion of the stages of anesthesia in addition to bringing about a shift to the right of the reaction sensitivity. Not only is excitement or delirium practically inevitable but a larger dose of anesthetic is required and induction takes longer. Adequate sedation, by diminishing the patient's excitability or by reducing the basal metabolic rate, results in a smaller dose of anesthetic and a shorter period for traversing the stages of anesthesia. The concept that patients vary considerably in their response to various agents both as to dosage and reaction may be applied to agents other than procaine.

[For many years anesthetists have used the admirable chart of Guedel for determining the stages of anesthesia. With the introduction of drugs other than ether and with improved and altered technics, it is unquestionable that there is room for development of a new approach to the recognition of response to drugs.—Ed.]

Pulmonary Function as Affected by Operative Position. A. Sokalchuk, D. Ellis, C. Hickcox and E. M. Greisheimer[1] (Temple Univ.) studied the influence of operative positions on various static and dynamic pulmonary functions in three healthy men and five healthy women aged 23-55. Variations in the average results shown in the table are less than those expected when the influence of premedication and anesthetic agent are considered. Factors such as intercostal paralysis after curare, retraction in the upper abdomen, tired assistants leaning on the patient's chest and the use of rests impair respiratory movements. The patients complained of the discomforts of the kidney, gallbladder and lithotomy positions. Oxygen use was highest when the

(1) Anesthesiology 10:577-584, September, 1949.

AVERAGE RESULTS FOR ALL SUBJECTS IN VARIOUS OPERATIVE POSITIONS

Positions	Resp Rate /Min	Tidal Vol. Cc. /Breath	MVR, L./Min	O_2 Use, Cc./Min	MBC,† L./Min	V E.,‡ L.	% Reserve	V C.§ Cc.	Complemental, Cc.	Reserve, Cc.	Rate during MBC/Min	Depth during MBC, Cc. /Breath
Sitting	12.6	634	7.61	317	103	2.4	92	3,515	1,547	1,302	39	2,751
Supine	12.0	638	7.25	281	100	2.6	92	3,355	2,088	613	42	2,409
Prone	11.6	695	7.67	301	97	2.6	92	3,287	1,696	835	40	2,459
Trendelenburg	10.9	716	7.35	295	89	2.6	91	3,188	2,125	463	37	2,489
Reverse Trendelenburg	10.7	661	6.98	269	99	2.6	92	3,499	1,886	816	37	2,650
Right kidney	11.5	634	7.13	295	92	2.5	92	3,100	1,485	973	37	2,568
Left kidney	12.0	623	7.26	298	95	2.4	92	3,037	1,399	1,081	37	2,569
Right lateral	10.7	691	7.02	292	94	2.4	92	3,252	1,753	877	36	2,500
Left lateral	11.4	612	6.64	291	95	2.3	93	3,350	1,750	1,007	39	2,697
Gallbladder	10.6	645	6.83	275	82	2.5	92	3,075	2,020	538	35	2,631
Jackknife	12.4	653	7.81	280	92	2.8	91	3,202	1,806	755	36	2,573
Lithotomy	11.8	709	8.47	354	100	2.4	91	3,233	1,850	597	39	2,591

MVR minute volume of respiration; † MBC, maximal deep breathing capacity; ‡ V E. ventilatory equivalent; § V C. vital capacity

lithotomy position was used In the jackknife position the subjects were comfortable

The most favorable positions for normal pulmonary functions are supine (horizontal, without elevating rest), right and left lateral (horizontal without kidney rest), jackknife and lithotomy (horizontal) The unfavorable positions are Trendelenburg, kidney (with rest) and gallbladder (with rest)

[Although the changes in pulmonary function are not exceptional, it is to be emphasized that these patients were not embarrassed by the factors present during anesthesia and surgery. The article points up the significant influence on vital functions that position of the patient can have and it is imperative that this influence be recognized as a highly probable source of difficulty in many patients. By suitable choice of drug and technic and by expert administration of the anesthetic, equivalent or improved operating conditions can often be provided for the surgeon without resort to positions which diminish pulmonary function.—Ed.]

Postanesthetic Encephalopathy Postulation of Cerebral Edema as Basis for Rational Treatment. Thomas H. Seldon, Albert Faulconer Jr., Raymond F Courtin and D M Pino[2] report two cases of severe postanesthetic encephalopathy with cerebral changes and neurologic signs typical of anoxia. Both patients presented features of grave prognostic significance The first, a woman 27 underwent radical mastectomy Induction was with 80 20 nitrous oxide-oxygen mixture and ether and anesthesia was continued with ether and oxygen. The patient was comatose for 36 hours post operatively The second patient, a man aged 50 was to be operated on for carcinoma at the base of the tongue and insertion of radium. Induction was with a 2.5 per cent solution of pentothal® sodium, but after two minutes the air way became completely obstructed owing to laryngospasm Because of carcinomatous involvement of the epiglottis and surrounding structures the larynx could not be visualized with a laryngoscope and tracheotomy was done for eight minutes the patient was unable to obtain an inspiration of air Striking changes in each patient's appearance and condition were observed in the postanesthetic period immediately after administration of 100 cc of 25 per cent human serum albumin.

Since human serum albumin is known to be an effective agent for reduction of cerebral edema, it is suggested that

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the change observed was a result of coincident improvement in the cerebral edema after the anoxic episodes It is suggested that permanent damage to the brain as a result of acute cerebral anoxia is not only a function of the duration of the anoxic episode but also, in the case of sublethal periods of anoxia, must be conditioned by duration and severity of a period of postanoxic cerebral edema. On the basis of the present experience, treatment for cerebral edema should be initiated immediately after such episodes.

[One of the most exasperating and frustrating experiences of surgeon and anesthetist is the treatment of postanesthetic encephalopathy Obviously the best treatment is prophylactic but this article presents an approach to therapy of the disorder which may prove beneficial in certain patients and merits cautious trial. One should not forget, however the hazard of circulatory overload that may accompany the use of serum albumin.—Ed.]

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